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The MONTHLY REVIEW

Published by the AMERICAN ELECTRO-PLATERS' SOCIETY

A Society for the Advancement of the Science of Electro-Plating

JUNE 1936 · IN THIS ISSUE

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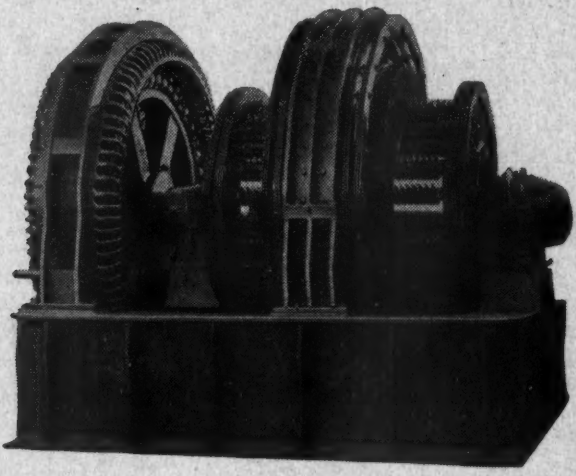

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The Monthly Review

Published by the
AMERICAN ELECTRO-PLATERS' SOCIETY

Publication and Editorial Office
90 Maynard St.
Springfield, Massachusetts

VOL. XXIII JUNE 1936 NO. 6

Editorial

The 24th Annual Convention of the American Electro-Platers' Society was held at the Carter Hotel in Cleveland June 1-4, 1936.

There was a splendid attendance at all the meetings, enthusiasm was unbounded, and the weather conditions all that anyone could desire.

The educational sessions and social events were splendidly arranged and not a moment of monotony was allowed to creep into the proceedings from start to finish.

THE FELLOWSHIP CLUB SCORES AGAIN

The Monday evening of the convention was in charge of the Fellowship Club and, as in past years, this has come to be regarded as the social get together event of the Convention. Refreshments were plentiful.

Harmony and good cheer with the renewing of acquaintances prevailed at the gathering, interspersed with dancing which was continued until late into the night. It was an evening well worth while and the International Fellowship Club is to be congratulated once more for the time and money spent for the entertainment of the delegates and their friends.

THE EDUCATIONAL SESSIONS

Many very excellent papers were read during the educational sessions, most of these were illustrated and were generally discussed at the close of the address. It was felt by some of our

members that at future conventions, the foreman plater should be induced to contribute to the educational sessions by presenting papers, as was customary at these sessions until quite recently. We hope the sponsors of the next convention will prevail upon the members capable of reading such papers, (and we have a goodly number to choose from)—to assume this obligation as in former times. In other words, we don't want our own platers to lose their contact with the educational sessions of the supreme society. The problems of the plating room are just as important and worthy of discussion to the man in charge of the plating room as the laboratory problems are to the research man and chemical engineer. A combination of both practical and technical papers makes an ideal program and should be encouraged by all means at future meetings of the Society.

THE BUSINESS SESSIONS

Particular interest should be manifested in the report of the Secretary-Treasurer as presented to the Branches and printed in this issue of the REVIEW. Note the splendid increase in membership, and the increasing surplus in our treasury.

Reports of the research committee by Mr. Wm. Phillips, educational by Mr. P. J. Sheehan and membership by Mr. Joseph Underwood all show the Society to be in a healthy state. With a progressive organization behind these committees we should show marked improvement from year to year, and a steady growth both numerically and financially as we face the future with an united front.

THE BALTIMORE-WASHINGTON AMENDMENT

After the usual discussion pro and con the amendment was carried by a vote of $62\frac{1}{2}$ to $16\frac{1}{2}$. This amendment provides for a full time executive secretary to be appointed by the executive board and combines the offices of Secretary-Treasurer, Editor and Treasurer of the research committee. In addition the newly appointed officer shall be expected to perform all other duties allotted to him by the President and members of the Executive Board.

OFFICERS

The following officers were elected for the years 1936-1937. President, E. Steen Thompson, Cleveland Branch; 1st Vice-President, P. J. Sheehan, Milwaukee Branch; 2nd Vice-President, James Hanlon, Chicago Branch.

1937 CONVENTION CITY

Considerable rivalry existed between the supporters of Milwaukee and New York City as to who should entertain the convention next year.

After stirring remarks by leaders of both sides including the President of the Milwaukee Chamber of Commerce the roll-call vote disclosed a victory for New York where the organization was founded by Mr. C. H. Proctor nearly a quarter of a century ago.

HONORARY MEMBERSHIP

Mr. Walter Fraine of Dayton Branch and Mr. Dan Wittig of Milwaukee Branch were made honorary members by unanimous vote of the assembled delegates. Mr. Fraine who was present responded with a deep feeling of thanks for the action taken by the convention. A few fitting remarks by Mr. Geo. Hogaboom regarding Mr. Fraine's services to the A. E. S. down through the years brought this well deserved tribute of admiration and respect to a close.

Mr. Fraine was then called upon to install the newly elected officers after which President Thompson was handed the gavel and declared the 24th annual session of the A. E. S. adjourned.

The Metal Industry Cup presented to the Branch giving the best exhibit of electroplated ware, was won by the Bridgeport Branch. This Branch has won the cup two years in succession and will be in permanent possession of the Bridgeport members if they are fortunate enough to win the desired trophy next year. All other Branches kindly take notice.

First Prize went to J. C. Singler, Member of Cleveland Branch.
Second Prize, J. P. Sexton, Member of Bridgeport Branch.
Third Prize, W. D. Scott, Member of Cleveland Branch.

RESULT OF THE PAPERS AWARD COMMITTEE

During the social events that followed the banquet on Thursday night, at the convention, time was called while Dr. Wm.

Blum, Chairman of the above Committee, made the following awards:

Founders Gold Medal to W. R. Meyer, Bridgeport Branch, active member.

The A. E. S. Gold Medal to Dr. D. A. Cotton, Associate Member.

ACTION REGARDING FUTURE EXHIBITS

The exhibit committee presented to the convention the following recommendation: That a moratorium on all paid exhibits be held for the next five years and that all future exhibits be controlled by the Supreme Society.

This action was prompted by a feeling on the part of many of our exhibitors that a yearly exhibit by them is not justified by the results obtained, and is a constant source of expense.

The suggestion of the Committee was agreed to by the Convention delegates after discussion, and a vote sustaining the recommendation was carried.

FIRST MEETING OF THE NEW EXECUTIVE BOARD

Immediately after the close of the business session on Thursday afternoon, President E. Steen Thompson called for a meeting of the Executive Board. The following appointments were made:

Chairman of Membership Committee, 1st Vice-President, P. J. Sheehan;

Chairman of Educational Committee, 2nd Vice-President, James Hanlon;

Executive Secretary, Wm. J. R. Kennedy.

An Open Letter

At the final business session held June 4th, 1936, the delegates voted to accept the amendments proposed by Baltimore-Washington Branch relative to the consolidation of the offices of Secretary, Treasurer, and Editor.

Later in this session your delegates elected as officers for the present year, Mr. E. Steen Thompson, President; Mr. P. J. Sheehan, Milwaukee Branch, First Vice-President; Mr. J. W. Hanlon, Chicago Branch, Second Vice-President.

These gentlemen, together with our retiring President, Mr. T. F. Slattery, comprise the Executive Board for this year. At a meeting of this Board following the final business session the appointment of ex-Editor W. J. R. Kennedy was made as Executive Secretary. Mr. Kennedy has accepted this appointment and the Branch Secretaries will in the future make all remittances payable to and send to Mr. Kennedy's office.

All matters relative to employment and other correspondence handled through the Secretary's office will now be handled by Mr. Kennedy.

At the Executive Board meeting referred to above Mr. P. J. Sheehan was appointed as Chairman of the Membership Committee and has agreed to serve. I earnestly request that the membership at large and the Branch Secretaries in particular will render Mr. Sheehan every aid in carrying out the plans of this Committee. You all know of the success of the Educational Committee during the past year under the guiding hand of Mr. Sheehan. We may look forward to a repetition of this success in his new role as the Chairman of the Membership Committee.

Another appointment was made at this meeting, Mr. J. W. Hanlon, Second Vice-President accepting the office of Chairman of the Educational Committee. The work of this Committee will carry on as outlined in the past year and Mr. Hanlon has been given the assurance of all assistance necessary in his work. Mr. Hanlon was also appointed Secretary of the Executive Board for the year.

It is hoped that the Branch Secretaries will be as prompt and cooperative this year as in the past, since this will greatly assist Mr. Kennedy in his work. Get back of the advertisers in the REVIEW, since your patronage helps to mould their reaction as to the use of this space. From the numerous concerns using our pages all requirements of the industry could be filled and we should not be backward giving the REVIEW credit for bringing about the contact with your supplier.

Your present Executive Board wishes to take this opportunity to thank the membership for the confidence made manifest in their selection and to assure all of their sincerity any decisions made during their term of office.

The appointment of Chairmen for the other Committees is under advisement and will be announced in a later issue.

Help us make this the best and biggest year in the history of the Society.

Fraternally yours,
E. STEEN THOMPSON,
President

To the Branch Secretaries and Delegates,
Greetings:

We are taking this means of informing you of the financial and numerical strength of our Organization.

Please give these reports careful study, since we will not present them in their entirety on the floor of the Convention.

Since the Convention from necessity convenes so soon on the heels of our past fiscal year, we have not been able to get this material into the mails. We ask if you will preserve your copy and hand it to your Branch Secretary upon your return from the Convention.

We are thankful for the kind cooperation of yourselves as Delegates and your Secretaries in the work of the past year, and wish to assure you it has been a pleasure to work with you.

Fraternally yours,
E. STEEN THOMPSON
Sec'y-Treas.

P. S. Just a reminder that if your Branch requires more than one copy of the Report of this Convention, it will be necessary to fill out the proper card to be found at the Registration desk. Thank you.

ANNUAL STATEMENT
OF THE
AMERICAN ELECTRO-PLATERS' SOCIETY
For the Year Ending May 31st, 1936

PARTICULARS			
RECEIPTS			
FROM BRANCHES			
Per capita tax	$2,652.64		
Convention reports	83.87		
Supplies	264.43		
	$3,000.94	$3,000.94	
Sale of Convention Reports to Members	423.30		
Sale of Advertising Space in MONTHLY REVIEW	3,996.83		
Sale of Specifications	176.25		
Received from Bridgeport Convention Committee	250.00		
Bank error	.03		
	$4,670.13	4,670.13	
Cash on hand, Bank balance May 31st, 1935		2,604.39	
Total receipts through May 23rd, 1936		$10,451.74	$10,451.74

Expenditures		
Printing and mailing REVIEW	$4,075.61	
Editor's Commission on 1934-35 Advertising	402.34	
Officers' Mileage	137.88	
Year's Subscription to Research	1,110.00	
Expenses of Educational Committee (Vice-President Sheehan)	142.14	
Reporting, printing and forwarding Convention Reports	952.20	
Printing Branch Supplies	159.48	
Research Committee:		
Printing Specifications	125.00	
Canvass of Membership	51.40	
Dies for New Gold Medal	20.00	
Two Gold Medals	26.00	
Convention Advertising, 1936	58.70	
Officers' Expense:		
President	55.96	
Editor	67.82	
Secretary-Treasurer	109.95	
Exchange on Checks, etc	.98	
Convention Report Cards	6.57	
Officers' Salaries:		
Editor	150.00	
Secretary-Treasurer	100.00	
Executive Board Grant to Sec'y, 1935	200.00	
" " " " " " 1936	200.00	
Protested check—through Bank error	88.26	
Checks unpaid June 1st, 1935— Nos. 55, 56, 57	85.43	
Total expense	$8,325.76	8,325.76

Recapitulation

Total Receipts through May 23rd, 1936	$10,451.74
Total Expenses " " " "	8,325.76
Balance on hand May 23rd, 1936	$2,125.98
Balance as reported by Marine National Bank, Erie, Penna. at close of business, May 23rd, 1936	2,125.98
Due from Branches	69.36
Due from Advertisers	311.30
Net worth June 1st, 1936	$2,506.64

AMERICAN ELECTRO-PLATERS' SOCIETY
ACCOUNTS RECEIVABLE FROM THE BRANCHES AND AMOUNTS PAID
June 1st, 1935 to May 23rd, 1936

BRANCH	Due June 1, 1935	Years Per Capita Tax	Convention Reports and Supplies	Cash Received	Balance Due
Anderson	$27.71	$65.69	$29.97	$123.37	....
Baltimore-Washington	....	91.89	14.84	106.73	....
Binghamton-Elmira	....	14.18	5.15	19.33	....
Boston	....	59.85	16.86	76.71	....
Bridgeport	....	146.56	16.45	163.01	....
Chicago	....	343.88	*123.84	467.72	....

Cincinnati	....	35.19	8.14	43.33	....
Cleveland	....	66.18	9.58	75.76	....
Dayton	....	74.55	10.13	84.68	....
Detroit	....	186.38	26.19	212.57	....
Grand Rapids	....	35.72	8.06	43.78	....
Hartford	....	63.53	10.04	73.57	....
Los Angeles	....	101.86	12.98	114.84	....
Milwaukee	....	108.17	12.97	121.14	....
Montreal	19.32	23.12	8.45	15.00	$35.89
Newark	114.51	132.85	14.65	262.01	....
New York	....	154.89	10.04	164.93	....
Philadelphia	....	200.55	x55.44	255.99	....
Pittsburgh	....	47.99	8.79	56.78	....
Providence	31.79	49.34	8.32	64.38	25.07
Rochester	....	104.49	12.75	117.24	....
San Francisco	15.18	31.09	7.79	54.06	....
St. Louis	....	56.72	9.10	65.82	....
Springfield	....	17.85	6.18	15.63	8.40
Toledo	....	45.15	8.29	53.44	....
Toronto	....	78.22	11.32	89.54	....
Waterbury	....	80.86	11.45	92.31	....
	$208.51	$2,416.75	$477.77	$3,033.67	$69.36

Total of Columns 1, 2 and 3—Accounts Receivable $3,103.03
Less Cash Received from Branches 3,033.67

Due from Branches $69.36

*This item includes $88.26 check protested thru Bank error.
xThis item includes $31.25 for specification pamphlets.
Providence and Springfield Branches have sent checks for full amount since above date.

AMERICAN ELECTRO-PLATERS' SOCIETY
REPORT OF MEMBERSHIP TURNOVER
For the Year Ending May 31st, 1936

BRANCH	Members May 31, 1935	Elected	Re-instated	Gain by Transfer	Loss by Transfer	Suspended	Resigned	Died	Total for May 31, 1935	Net Gain	Per Cent Gain
Anderson	25	16	0	0	0	6	0	0	35	10	40%
Baltimore-Washington	36	22	0	1	0	0	0	0	59	23	64%
Binghamton-Elmira	..	11	0	3	0	0	0	0	14	New Branch	
Boston	24	37	2	0	0	0	0	0	63	39	162%
Bridgeport	69	10	1	1	1	8	1	2	69	00	00
Chicago	165	12	1	0	2	5	1	0	170	5	3%
Cincinnati	16	1	0	0	0	1	0	0	16	00	00
Cleveland	29	6	0	0	0	0	0	1	34	5	16%
Dayton	35	1	0	0	0	0	0	0	36	1	3%
Detroit	83	16	1	3	0	0	3	0	100	17	20%
Grand Rapids	17	1	2	0	0	2	0	0	18	1	6%
Hartford	33	1	0	1	6	5	1	0	23	−12	−33% loss
Los Angeles	50	4	1	0	0	6	1	0	48	−2	−4% loss
Milwaukee	48	8	0	0	0	2	0	0	54	6	12½%
Montreal	11	0	0	0	0	0	0	0	11	00	00
Newark	62	3	0	0	1	0	0	0	64	2	3½%
New York	76	0	1	0	0	3	0	3	71	−6	−6½% loss

Philadelphia	92	13	1	0	2	1	0	1	102	10	11%
Pittsburgh	22	2	0	0	0	0	1	1	22	00	00
Providence	24	0	0	0	0	0	1	0	23	–1	–4½ loss
San Francisco	14	2	0	0	0	0	0	0	16	2	14%
Rochester	51	6	0	1	1	8	0	0	49	–2	–4% loss
Springfield	..	12	0	6	0	0	0	0	18	New Branch	
St. Louis	27	0	0	0	0	1	0	0	26	–1	–3½% loss
Toledo	20	2	0	0	0	0	0	0	22	2	10%
Toronto	34	14	2	0	0	2	0	0	48	14	41%
Waterbury	37	4	0	1	0	0	0	0	42	5	13%
	1100	204	12	17	13	50	9	9*	1253	144	14% gain

*Death of Palmer H. Langdon - Honorary Member Supreme Society.

SUGGESTED BUDGET FOR A. E. S. 1936-1937

RECEIPTS	1935-1936	1936-1937	*Increase*	*Decrease*
Per capita tax	$2,400.00	$3,000.00	$600.00	....
Advertising	4,200.00	5,000.00	800.00	....
Sale of Convention Reports ($3)	500.00	($5)800.00	300.00	....
Total	$7,100.00	$8,800.00	$1,700.00	....
EXPENDITURES				
Printing and Mailing REVIEW..	$4,075.00	$4,500.00	$425.00	....
Convention Report	950.00	800.00	....	150.00
Ex. Sec. Salary				
Editor	550.00	....	....	....
Secretary	300.00	2,400.00	1,550.00	....
" " Traveling Expense	....	600.00	600.00	....
Executive Board Mileage	100.00	100.00	....	....
" " Office Exp.	200.00	200.00	....	....
Subscription to Research Fund..	1,110.00	....	....	1,110.00
Miscellaneous	200.00	200.00	....	....
Total	$7,485.00	$8,800.00	$2,575.00	$1,260.00
			Increase	$1,315.00

Signed, T. F. SLATTERY.

May 22nd, 1936.

ABSTRACTS FROM THE OFFICIAL CONVENTION NEWS

Published by Hanson-Van Winkle-Munning Co.

ALL COMMITTEES DESERVE MUCH CREDIT

Preparatory Work Assured Success

When looking back over several days of such an enjoyable time as we have all had, do not forget that it was largely due to advance activities of a group of Committees who really started planning months ago.

Although we have seen much of the activities of the various Committees during the Convention; have seen them handle registration, business meetings, exhibits, entertainment and other features—yet one must keep in mind the fact that "carrying on" the work during the Convention has been a small part of their labor. Arrangements had to be made, programs built, exhibits prepared and a thousand other details that have not come to light during the visit of the delegates.

We feel sure that every member, guest and Officer of the Association joins us in extending a vote of appreciation to the various Committees.

Our Hats are Off to the Cleveland Branch

No matter how fine the crowd, how good the Exhibits, how nice the hotel headquarters—our hats are off to the Cleveland Branch. This group of electroplaters has arranged a great Convention and everyone is pleased.

You will find the History of the Cleveland Branch on one of the pages near the back of your Convention Program. It is worth reading just to learn the background of this active group.

We also list here the Cleveland Branch officers, but want to state that by their own say-so the arrangements could not have been completed without the loyal support and enthusiastic work of every Branch member. The Officers are: President, William D. Scott; Vice-President, Henry A. Weber; Sec.-Treas., William E. O'Berg, and Librarian, H. J. Ter Doest.

The ladies of the Convention have been more or less conspicuous by their absence during the business sessions—a fine tribute to the interesting and entertaining arrangements made by the Ladies' Entertainment Committee.

Electroplating is considered a health hazard occupation, but is it? All 19 past Presidents of the A. E. S. are still alive and enjoying good health. Look at those at this Convention—ten of the 19 are here:

H. A. Gilbertson, O. E. Servis, Walter Fraine, Edward Musick, Frank J. Hanlon, Walter Barrows, George Gehling, John Sterling, Frank Mesle, and George B Hogaboom.

Walter J. Meyer, General Electric Co., Bridgeport, Conn., received honors at Yale for this year's work for a doctorate degree in metallurgy. Success with your thesis, Walter.

Charles H. Proctor, founder A. E. S., has purchased a home in Florida. We send our best wishes.

The Exhibits

Chairman R. T. Phipps of the Exhibit Committee and his loyal helpers again receive a vote of thanks from every member of the A. E. S. It has not been an easy matter to have the 67 booths built and arranged, to have provided for the necessary wiring of current, to have corresponded with all exhibitors and so satisfactorily met their requests.

It is not out of order to compliment the Exhibitors too and point out that their hearty cooperation in taking the space and preparing such attractive displays has gone a long way toward making our 24th Annual Convention a success.

A list of Exhibitors is given on a page of the official program and we earnestly urge every member and guest of the Association to show his appreciation by thoroughly studying the products shown and remembering them in the future when ordering new equipment and supplies.

Total Registration Breaks All Records

Although the figures for delegates registered up until six o'clock tonight vary little from those published in yesterday's issue of the "News" yet it seems well worth while to emphasize again that the 24th A. E. S. Convention has broken all records. Our registration figures show 532 as compared to last year's record of 498 made at Bridgeport. "Bigger and Better" seems to be the motto of the A. E. S.

Our hats off to the Thurstons, who travelled all the way from Sydney, Australia, to attend the Convention.

X-Ray Methods *of* Diffraction *Analysis as Applied to* Electroplating *Problems*

HERBERT R. ISENBURGER
St. John X-Ray Service, Inc.
Long Island City, N. Y.

ABSTRACT

THE basis of X-ray diffraction analysis. Discovery of X-ray diffraction in crystals. Bragg's law of X-ray diffraction. Moseley's law of atomic numbers. Production and measurement of X-rays. General principles of X-ray diffraction methods. Laue method. Hull or Debye and Scherrer method. Standardized equipment. Quadrant diffractemeter. Special methods of mounting specimens. St. John's transmission method. St. John's surface reflection or focusing method. Interpretation of diffraction patterns.

X-ray Diffraction Analysis is the study of the arrangement of the atoms in materials by means of X-rays. It supplies information concerning the atomic arrangement in the particles making up a mass; the size of these particles; their shape and the way they are arranged within the mass; the changes that take place in any of these conditions as the result of thermal, mechanical or chemical treatment; similarity, identity or difference of two materials; and any other characteristics directly dependent upon atomic arrangement.

Since many of the more important properties of electro-plated deposits depend upon just such factors, and since this method is the only one competent to secure such data, its importance can scarcely be exaggerated.

X-ray diffraction analysis is based upon a series of epoch-making discoveries beginning with Roentgen's discovery in 1895.

In 1912 v. Laue suggested that if X-rays are similar to light waves, their wave-lengths must be of the same order of magnitude

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Note—For those who wish to obtain more information on the physical properties of X-rays, we refer to a recent book by Dr. Ancel St. John and Herbert R. Isenburger on "Industrial Radiography", published by John Wiley & Sons, New York, 1934.

as the small distance between neighboring atoms in a crystal, namely, about one hundred millionth of an inch. It is well known that when a distant light is viewed through a wire screen or an umbrella cover a more or less symmetrical pattern of spots is seen. The character of the pattern changes when the nature of the light or the relative position of the light, the cloth, and the eye are changed, or the cloth is distorted, or cloth of a different weave is substituted. This pattern is due to diffraction, or what may be called "co-ordinated scattering" of the light waves passing through the orderly array of openings in the cloth. A much simpler pattern is observed when a series of lines ruled on a transparent surface known as a *diffraction grating*, is substituted for the cloth. A more complicated pattern would be produced by a series of screens at equal distances. The ordinary diffraction grating is one-dimensional, the cloth two dimensional, the series of screens three-dimens onal. Laue, therefore, predicted that if the atoms in a crystal are arranged in an orderly manner they should constitute a three-dimensional grating for light waves of the order of magnitude in question, and that consequently a diffraction pattern should be produced when X-rays traverse a crystal. This was promptly confirmed experimentally by Friedrich and Knipping.

They proved all at one time the orderly arrangement of atoms in the crystal, the identity of X-rays and light waves, and the similarity of size between inter-atomic distances and X-ray wave lengths. As the atoms in a crystal are arranged in an orderly manner, numerous families of parallel planes can be passed through the atom-centers so that every atom-center lies in some plane of each family.

Three such families of planes in a simple cubic crystal are shown in Figure 1. Each family acts as a unit in causing diffraction so that each spot on the pattern represents diffraction from a particular family of planes. These characteristic arrangements of atoms are called *space lattices*. The relative positions of the spots are determined solely by the angles between the incident beam of X-rays and the line normal to each family of planes. Hence, the Laue experiment, while supplying the

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Note—Loc. cit. p. 24.

foundation for X-ray diffraction analysis, gave no information as to the actual magnitude of the X-ray wave lengths or the inter-atomic distances.

This was accomplished by W. H. and W. L. Bragg in 1913, when they showed how to determine inter-atomic spacings and X-ray wave lengths. By rotating the crystal during exposure to X-rays, the Braggs found that for any position of the crystal the intensity was a maximum when the diffracted beam made the same angle with the surface as the primary beam, and that very marked peaks occurred at certain settings of the crystal. In other words, the X-rays behaved as if selective reflection were taking place. From their measurements, the Braggs deduced the law of X-ray diffraction known as Bragg's Law. When two trains of waves travel from a source to a point of observation over different paths, they nullify each other more or less completely, unless they arrive in phase when they reinforce each other. They will arrive in phase only if their paths are equal or differ by a whole number n of wave length λ. Hence, when a train of X-rays is incident at an angle $\angle\theta$ upon a family of parallel atom planes a distance D apart, as shown in Figure 2, a series of trains will be scattered or diffracted from each plane. These trains will be in phase and reinforce each other most completely when the difference of path $2\,D\sin\theta$ between trains from successive planes is equal to $n\lambda$ a whole number of wave lengths. The equation

$$n\lambda = 2\,D\sin\theta$$

represents Bragg's Law of X-ray Diffraction.

In Figure 3 are shown the relative sizes of the angles due to diffraction of a particular wave length from the three families of planes illustrated in Figure 1.

Shortly after Braggs' discovery, Moseley used this method to secure X-ray spectra of several elements. When he measured the wave lengths he discovered that certain X-rays characteristic of the elements, already known as the K-radiation, L-radiation, M-radiation, and so forth, were groups of lines having definite wave-length ratios, not only among the lines of each element but also between corresponding lines of different elements

as illustrated in Figure 4. For any element the K-lines were shorter, more intense and more penetrating than the L-lines, the L-lines than the M-lines, and so on. Moseley's law that the wave lengths of corresponding lines of different elements are inversely proportional to a number associated with the properties of the element and known as the *atomic number* is the basis of identification of elements by X-ray diffraction.

While the World War was in progress and communications were interrupted, A. W. Hull in America and Debye and Scherrer in Europe, independently extended the Laue method to powdered and fine-grained materials and even to colloids. They replaced a single crystal by a specimen of fine-grained material.

Under these circumstances the X-rays traverse a multitude of minute crystals lying at random. As each one constitutes a three-dimensional diffraction grating for the X-rays for each spacing that exists in the material and for each wave length in the radiation, there is then a cone of diffracted rays about the central beam at an angle satisfying Bragg's Law. If characteristic wave lengths are present in the radiation, the cones due to these will have intensities considerably greater than those due to neighboring general radiation. A series of such cones is illustrated in Figure 5.

It is not within the scope of this paper to give a complete account of the production and measurement of X-rays. This will be found elsewhere in the literature. We merely recall that they are being emitted whenever matter is bombarded by cathode rays. The essential parts of an X-ray generating apparatus are, therefore, a source of electrons proceeding from a cathode, which is a hot-wire filament in a vacuum tube; a target or anode in the path of the cathode-ray stream; and a means of applying a potential difference between the cathode and the target which will accelerate the electrons to the required velocity during passage across the intervening space.

The quality of the rays can thus be controlled by the voltage across the tube and the quantity by the temperature of the filament. The quality also depends largely upon the material

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Note—Loc. cit. p. 51.

in which they are produced. The higher the atomic weight of the target material, the greater the speed required for an electron to penetrate to the interior of an atom; hence, the higher the critical voltage necessary to excite characteristic radiation.

The critical voltages for the K-radiation of materials commonly used as targets for diffraction analysis tubes and the wave lengths of the most prominent lines, the "alpha" line of each, are:

Target Material	*Voltage*	*Wave length*
Iron	7,500	$1{,}933 \times 10^{-8}$ cm.
Copper	9,000	1,537 x " "
Molybdenum	20,000	712 x " "
Tungsten	58,000	210 x " "

Hence, 30,000 volts will produce a reasonable intensity of the K-alpha radiation from molybdenum, a very great intensity from copper or iron and no K-radiation at all from tungsten.

Measurement of the intensity of X-rays after transmission through crystals or diffraction by crystals is accomplished by the ionization chamber or by photographic method. The latter is probably less exact and the measurement of intensities require the use of photometer. But it gives a complete account of the distribution of intensities over the entire area represented by the film and is both rapid and convenient.

In order to protect persons and equipment in the neighborhood from possible injury due to exposure to the X-rays, it is customary to surround the tube, at a safe distance electrically, with a metal case which will absorb the rays, and to provide this case with openings for egress of such rays as are to be used. See Figure 6. The direct or "primary" rays coming out through these openings and any "scattered" or "secondary" rays they may produce when they encounter the specimen, slit system or other objects, are in turn absorbed by the metal parts of the diffraction instruments or by auxiliary shields. Lead is most commonly used, because of its high absorption and low cost, but for low voltage work brass or steel may be sufficient. A complete equipment for X-ray diffraction analysis comprises a power generator, water cooled tube with molybdenum target protecting drum, and a number of pinhole as well as quandrant diffractometers.

Note—Loc. cit. p. 70.

As the K-radiation consists of a group of several lines of different wave lengths and different intensities, it is desirable at times to simplify the patterns by suppressing most of these. Fortunately, zirconium is much more transparent for the strongest line of molybdenum than for the others, and can be used as a filter to secure substantially "monochromatic" rays.

A diagram of a typical quadrant diffractometer is given in Figure 7. The X-rays leave the target at about 5° so that the focal spot appears as a line source, pass through a defining slit and a second slit to cut off the surrounding secondary beam, and fall upon the specimen where they are diffracted. The direct beam passes on through an absorber to the film where it records the zero line as the shadow of the specimen. The diffracted beams pass through a zirconium exide filter to the film where they record the diffraction pattern. A baffle is placed parallel to the direct beam a short distance above the absorber to prevent secondary radiations scattered from the absorber reaching the rest of the film.

If the instrument is divided into two symmetrical parts by a thin metal plate perpendicular to the axis, two specimens can be exposed simultaneously. Under these conditions for both patterns, the character and intensity of the X-rays striking the specimens are the same, the paths of the rays in the direct beam are symmetrical, the film, exposure and development are the same; the only variables are the condition and structure of the specimens. Any differences in the two patterns whether in position, definition or intensity of the lines, must be due to differences in size, shape or mode of packing the specimens or to structural differences in the materials.

Three general methods of securing diffraction patterns have been mentioned above: the Laue, Bragg and Hull methods. Many particular modifications of these have been suggested from time to time, each with its own usefulness. Certain ones which combine a reasonable degree of precision with reasonable speed and convenience have been developed by the author's organization and have been adapted to industrial purposes. The type of tube, the target material, the voltage and current, the relative position of tube, defining slits, specimen and film holder, and the dimensions of instruments are chosen to meet particular con-

ditions. They are usually maintained unchanged so that variation in the pattern may be assignable to conditions characteristic of the specimens.

The specimen is generally held in a fixed position but at times it is desirable to rotate it slowly or to rock it back and forth. In the subsequent discussion it will be convenient to refer to methods as Transmission and Surface Reflection. Transmission methods are those in which the X-ray beam passes through the material to be examined, giving results which are mainly representative of the body of the material. They are particularly useful for materials that are reasonably transparent to the X-rays used. For more opaque materials, the specimen must be very thin. Surface reflection methods are those in which the X-ray beam falls upon a surface inclined at an angle more or less acute, giving results which are mainly representative of the surface layers. The latter method suggests itself to electro-plating problems although in certain cases a transmission method may be applicable. For both methods a quadrant diffractometer, as shown in Fig. 8, is suitable, the only difference being the mounting of the specimen. Various specimen holders have been developed for this purpose.

A convenient transmission method is the wedge mounting of the specimen. A slit system is placed with its face toward the X-ray tube with one edge on the axis of the instrument, and the specimen is placed against the face of the slit system shown in Fig. 9. Under these circumstances the X-rays which come from the far side of the focal spot and just graze the upper edge of the slit determine the upper edge of the zero line. Furthermore, the portion of these rays diffracted at a particular angle by the particles of the specimen immediately adjacent to this edge of the slit will determine the upper or outer edge of the diffracted beam. In the undeviated beam all rays from other parts of the focal spot and all rays through other parts of the slit will fall below the limiting rays and record the rest of the zero line. Similarly in the diffracted beam, all rays from other parts of the focal spot, all rays through other parts of the slit and all rays diffracted by other particles in the specimen, will fall within the limiting rays in the diffracted beams and record the rest of each line. When a suitable absorbing screen is interposed in the

undeviated beam so that the intensity at the film is comparable with one of the strong lines in the pattern, the zero line will always be sharply defined. The edges of the lines in the pattern will also be sharply defined unless the condition of the specimen makes them diffuse. The degree of diffuseness is then related to the degree of smallness of the particles in the specimen.

The method more frequently adaptable to electroplating problems is the surface reflection method. A suitable way of mounting specimens for this analysis is illustrated in Fig. 10. The specimen is formed so that its surface is a portion of a small cylinder placed tangent to the X-ray beam at the axis of the instrument. For a particular line in the pattern the effective portion of the specimen lies between the axis and the tangent plane from the line. While it is actually a convex surface the distance between its highest point and the circle passing through the focal spot, the axis and the diffracted line is so small compared with the dimensions of the instrument that most of the energy in the diffracted beam is concentrated into a narrow band with a sharply defined edge.

After having thus demonstrated the way in which diffraction patterns can be secured, let us return to Fig. 1. While we know some thirty-two classes of different kinds of crystals, only the three kinds here represented are of immediate importance to the electroplater. They are called (a) face-centered cubic crystals, (b) body-centered cubic crystals, (c) hexagonal crystals. To the first group belong metals which are ductile, such as copper, aluminum, silver, gold, lead, nickel, and that variety of iron known as the *δ*-type. To the second group belong *X*-iron and the brittle metals, such as molybdenum, tungsten, chromium, and so on; and to the third group belong zinc, osmium, and some few others.

The families of planes are commonly identified by the "index" of the "form". A form comprises all the families having a common characteristic, as all three families parallel to cube faces in the cubic system. The index of the form is the series of numbers giving the reciprocals of the intercepts in the axes for that plane of the form which intersects one axis at unit distance, intersects the others on the positive side and passes nearest the origin. Thus in the cubic system where the axes are mutually

perpendicular the faces are normal to one axis and parallel to the other two, i. e. intersect them at infinity. The index is 100. Planes through opposite edges intersect two axes at equal distances and the third at infinity, giving the index 110. Planes through three opposite corners intersect all three axes at equal distances giving the index 111. Planes through an edge and the middle of the opposite side intersect two axes in the ratio 2:1 and the third at infinity, giving the index 120. Planes through two corners and the middle of the opposite edge intersect the axes in the ratio 2:2:1, giving the index 112.

The indices of the other forms are determined similarly. For systems other than the cubic, distances between adjacent atoms on rectangular axes may be different or the angles between the axes may not be right angles. For these cases "unit axes" and axial angles must be specified. Certain arrangements, however, are comparatively simple and for each such arrangement the ratios of the spacings for the various forms to the spacings of the simplest form is constant, no matter what the scale chosen, i. e., is independent of the size of the atoms. For many of these comprising three groups of the tetragonal system, in which the unit axes are mutually perpendicular and at least two are equal, and three groups of the triangular or hexagonal system in which two unit axes are equal and at 120° with each other and the third is perpendicular to these, charts on semi-logarithmic paper showing spacing ratios for the forms for various axial ratios have been prepared.

The full interpretation of diffraction patterns involves a consideration of the position of the lines, of the sharpness or diffuseness of the lines, of the relative intensities of the different lines in a single pattern, of the variations in the relative intensities of corresponding lines in different patterns and of variations of intensity of different parts of the same line. As already pointed out the position of a line is measured as the distance from the zero line to the "end point" or reference point on the line. This end point may be the outer edge, the inner edge, or the average position, depending on the way the specimen is mounted, and may require correction on account of the shape or position of the specimen. This distance x may be measured in inches or millimeters and the corresponding angle 20 determined from the

constants of the instrument used. The spacing D can then be calculated according to Braggs' Diffraction Equation, or the value of D may be read from a table previously prepared for use with the instrument.

Any change in the position of a line means a change in the corresponding spacing in the particles of the material. It is obvious that no such change can take place in one family without the accompaniment of co-ordinated changes in all other families except those normal to it. For two atomic arrangements to be completely identical it is thus necessary for all lines in the pattern of either to coincide exactly with the corresponding lines in the pattern of the other, as in Fig. 11a. Lack of correspondence indicates some difference in structure; Fig. 11b. If proportional changes take place for all families the ratios for the various spacings are not changed, the patterns remain similar, but all the lines are shifted, as in the case of two alloys of different composition, illustrated in Fig. 12a. The same is true if two elements have the same crystalline habit. Thus X-iron and tungsten both crystallize in the body-centered cubic system, hence, as shown in Fig. 12b, the two patterns are similar but as the tungsten atoms are larger and the planes farther apart all the angles in the tungsten pattern are smaller and the lines are nearer the zero line. The character of the lines, whether continuous and diffuse, continuous and sharply defined, or consisting of discreet spots or spreckles, depends upon the size of the particles causing the diffraction.

A single crystal in a fine beam gives rise to a more or less symmetrical pattern of spots. Hence, the portion of the sheet brass represented by the pattern of Fig. 13a is a single crystal with an axis nearly parallel to the X-ray beam. Several crystals together give rise to overlapping sets of patterns as illustrated in Figs. 13b and c. A better idea of the relation between particle size and the appearance of the patterns can be secured from Fig. 14. In this Fig. (a) represents a material as received in the form of a 60 mesh powder, (b) the portion of this powder remaining on a 150 mesh screen, (c) that passing 150 and remaining on 270 mesh, and (d) that passing the 270, (e) illustrates the effect of a chemical treatment, which has changed the structure completely, and (f) presents a form of the original material which

has been prepared in a fine state of subdivision by chemical process. Fig. 15 presents a series in which the particles range from those visible under a high-power microscope, through colloidal dimensions, to those only a few atoms in diameter.

The relative intensities of the different lines in the same pattern depend primarily upon the atomic arrangement within the grains. In the simplest possible arrangement, the simple cubic, where atoms are placed at the common corners of an array of adjacent cubes, three families of 100 planes lie parallel to the three pairs of cube faces, six families of 110 planes pass through opposite face diagonals, and four families of 111 planes pass through adjacent face diagonals. Hence, there are three chances for diffraction characteristic of the first set to six for the second and four for the third. Similarly the more complicated families would have other chances and the lines would vary in intensity on that account. The same principle holds true for more complicated structures with the added factor of enhancement or weakening of certain lines if single atoms are replaced by groups of atoms giving opportunity for phase differences between unequally spaced planes in a family.

Differences in relative intensity of corresponding lines in two patterns exposed simultaneously on the same film are generally due either to differences in the shape or orientation of the particles within the samples or to differences in the proportions of two or more constituents. The two causes are readily distinguished as the former produces varying degrees of enhancement or weakening of the various lines as shown in Fig. 16a, while the latter produces proportional enhancement or weakening of groups of lines as shown in Fig. 16b. Distortion of the particles within the material is also detected readily by the pinhole method. The distorted particles cause radial streaks, the so-called "asterism" to appear in the pattern as a result of straining the particles beyond their elastic limits. The effect upon the pattern of soft sheet brass, Fig. 17a, as a result of flexing it several times is shown in Fig. 17b.

While most of the X-ray results shown here have been obtained with molybdenum radiation at relatively low voltage and high milliamperes, necessitating very long exposures—sometimes lasting over an entire week-end—the patterns shown in Fig. 17

were made with tungsten radiation using a high voltage and low milliamperage with two hours of actual exposure time. The pinhole instrument used for this high-speed, high-voltage X-ray diffraction analysis is shown in Fig. 18. This quick and convenient method is an application of the Laue crystal analysis. The instrument, or several of them, can be mounted on existing radiographic equipment and may be used simultaneously while inspecting castings or welded pressure vessels. If desired, entire sheets or formed articles can be mounted in the instruments, or specimens can be cut without affecting the portion to be examined.

In concluding, the writer desires to express his appreciation to his associate, Dr. Ancel St. John, for his valuable assistance in the preparation of this paper. (Applause)

DR. BLUM: As Dr. Isenburger has indicated that he will at some later date to which we will look forward discuss the actual applications of these X-ray measurements to problems of plating, we shall not attempt to discuss those this evening, but if there is any question regarding the procedure which can be answered briefly, we shall be glad to take time for that at this time.

MR. MEYER: May I bring out just one point in the discussion of the diffraction angle? I thought it might be apropos to mention to the Society that in X-ray reflection it is different from mirror reflection. In a mirror you can reflect from any angle and the angle is set very definitely from the crystal. Isn't that correct?

DR. ISENBURGER: Yes, that is correct.

MR. MEYER: We are apt to confuse the two. That is that marked distinction that the angle must be very definite.

A LETTER FROM MR. EICHSTAEDT

September, 1884, is a long time ago. The plating industry at that time was not altogether different, that is to say, not much! Except that we had no high speed methods as highly developed as at present. There were high speed methods even then. There were very few however who could use them.

We had nickel, copper, brass, bronze, tin, zinc, gold and silver

electro depositions which were as good if not much better than we now have under these high speed methods we hear so much about. There were also all of the oxidized finishes we have today and some of these were even better than many of the oxidized finishes of today, which are much more simplified in the methods now in use for production purposes. Lacquers also were then even better than some of the modern developments of lacquers and application methods of them. Please do not understand me to belittle the present methods of producing a fairly good deposition of metals for protection of the base metals and the beautifying finishes.

I simply wish to state here that so far, either of these uses of electro deposition of metal was as good at that time as at present. The electro-plater of that time was considered something of a magician. We did not have but a very few chemists who knew very much about electro-plating. But we did have a few. There were no colleges with classes of students in electro deposition of metals. The electro-plater has improved very much since then and it is very interesting for one who has been close to the plating industry during all that time up to the present. There was no electro-plater's society where methods and processes were discussed and experiences exchanged, and there was no chromium plating on a commercial scale either. One who has watched the developments during all this time, 1884 to 1936, 52 years, should have a wonderful store of recollections and experiences. I do not expect to give them all. It would make a large book. I will, however, try to mention a few of what seem to be the most important mechanical developments in the industry.

Generators. The source of electric current for the deposition was no small problem. There were generators and generators. We used to call them "Dynamos". They have been very efficiently improved and at the present time it is hard to say what their future will be with the new rectifier which has been developed here in this country and has been put into use in England, Germany, and France before it has been given a chance in this country. I believe the rectifier will revolutionize the current problem, if it can be developed so as to have a constant flow of current when set at that certain voltage which I under-

stand is not quite developed to be entirely dependable. However I believe it is now as dependable as many of our present "Generators".

Then there is the development of agitation and filtration of solutions. The plating barrel has also had a wonderful growth and now one can get a plating barrel that will do the kind of work one wants, along also comes the continuous automatic equipment for electro plating. One must not forget to mention the polishing and buffing which are the principal operation in preparing the base metals for the plating.

The equipment for these operations has had a wonderful growth and now is very highly developed but there is still much room for improvement.

The automatic polishing machine plays a large part both in economical and efficient production of a well-polished surface of the base metal. There has been a wonderful development of polishing wheels and buffing wheels.

Then also there is the tumbling barrel which has played a big part in the finishing of such work that can be done in them. They have been developed up to the present to such an extent that it is astour ding to see some of the finished products that can be obtained in them "by tumbling process" which covers dry tumbling and wet, also ball burnishing and buffing in barrels. Also the barrel plating or shall we say the plating barrel? This process at the early beginning (I shall roughly put at 1896) before there really was a plating barrel of any account, and now. Well, there are all kinds and there are particular kinds for certain kinds of work. There is hardly any plating barrel that can be used for all kinds of work.

If I were to state what is the most pronounced development in the electro deposition of metals during this period I am writing of, I would not say it was in the mechanical developments or even in the composition of solutions. After all, the composition in the solutions have not changed excepting in proportions of this and that, a little more metal content or a little more conducting salts or brightener. I would say the most wonderful development in the electro plating industry is the electro-plater and anyone who has followed the industry closely cannot help but see this and I give credit to the metal industry and The Americal Electro Platers' Society for this development.

The electro plater of today is more than a magician. He is an electro Chemical Engineer.

The growth of the American Electro Platers Society has not had the growth it should have had. However it is growing. The old time hard-shelled secretive plater has no more chance of holding down a job without having the chemical knowledge, at least enough of it to control his solution, or else has the good sense to have someone under him who can control the solutions by analysis.

There is still much to be done and it is gratifying to see younger men coming along to fill the places of those who are not as young or active as they were once, and the young men are more capable of carrying on this wonderful work of electro deposition of metals which some have called an art,—it is all of that.

T. C. EICHSTAEDT.

Spectrograph Analysis *As Applied to* Electroplating

DR D. T. EWING

THE subject as announced is too technical for presentation at this time of the night, and I am going to give, very informally, an abstract of what I intended to say rather than to go into very great detail.

I shall consider applications of the use of the spectrograph to the electroplating industry for the next few minutes, and limit my remarks to analytical procedures. There is a further limitation placed upon what will be said. I shall consider only methods such as can be applied to qualitative and quantitative determinations of metals present in a very small amount in large amounts of other metals. By small amounts, I mean quantities of the order of one or fifty or one hundred milligrams per liter, and multiples of those magnitudes. We will give more particular attention to the case of nickel solutions, and we will try to show through spectrograms that these amounts of zinc, cadmium, copper, and so on, may be determined very accurately and quickly.

I do not care to take time to go into a discussion of the principles of the spectrograph this evening, but I might sketch on

the board in outline what the apparatus includes, in the way of an optical set-up. (Illustrating) It is well known that when light strikes a prism (if it is the kind of light that is not monochromatic)—sunlight, for example—it is broken up into the different colors. A beam of light from the source passes through a slit, which may be considered as the source of the incident ray which falls on the prism, and is bent by the prism breaking it up into the different wave lengths. Using another lens, we may see that the image of the slit is in this position.

A spectrograph may be considered as a spectroscope which carries its own camera. That is, instead of using the eye to detect various effects, a camera set-up and photographic materials are used as illustrated. The plate is placed at the proper angle. (Illustration) The red end is the farther one and the shorter one is toward the violet. On this plate, when developed, will be a series of lines, images of this slit which I have indicated, and the spectrograms which I will show are nothing more nor less than images of a slit which are placed in a definite arrangement for every metal, and the intensity of the lines is a measure of the amount of the substance producing radiations.

Let me show you the first spectrogram. I shall have to try to do two or three things at once, because the slide which I am showing is an original ten-inch plate and not of the ordinary lantern slide size, so I shall have to place this in a special holder and move it from time to time in order to point out certain portions to represent what I have to say.

Slide No. 1. This portion of the spectrogram from 4,000 units to about 7,000 Angstrom units is that visible to the eye. Below 4,000 Angstrom units is what is known as the ultraviolet, and extends down to a region of approximately 2,000 Angstrom units. The upper spectrum is that of iron. Every line has been measured and accurately evaluated in Angstrom units. The iron spectrum is often used as a reference for identifying lines of other metals.

The next spectrum is that of lead. Please note these very heavy lines. For example, there is a group that is very characteristic of lead. The next spectrum is that of gold, and below that is one of platinum. Then we find tin with certain characteristic lines that are dotted to refer to later, these especially. These lines are finger prints, let us say, of the metals. They

are definite. They never vary from one day to another or from one sample to another. Their position is fixed.

The next spectrum is that of zinc, and silver is just below it. Those are the heavy lines of silver, 3,280.67 and 3,382.89 A° units in length, and there you see another heavy one of silver.

Here is zinc. That line is very intense. It has reversed itself on the photographic plate. The spectra which we have selected are those which I think have interest for the electroplater in general, namely, cadmium, copper, nickel and chromium.

We shall pass on rather hastily. Please note the large number of lines of nickel and of chromium. The spectra is like that of iron in this respect. The last one is a spectrum of an alloy—tin and copper. These three lines are in the green region of the visible, and please note they carry through and are found in the alloy. Take these two lines from the copper spectrum; they carry through. This one does not carry through. That must be another element. Here we find it in the tin. In other words, all of the tin lines and all of the copper lines have carried through. If one of these elements were present in only a small amount, the intensity of line is a function of the amount of metal present, and thus we have the basis of the method of a quantitative determination.

Slide No. 2. These spectra are produced by taking two electrodes of the substance and passing a direct current of two to twelve amperes from a 250-volt generator. In many cases where we cannot use the metal directly, but are analyzing a solution, a tenth of a cubic centimeter of the solution is placed on a carbon electrode and the proper current is passed. The elements are volatilized and their characteristic spectra form. The upper spectrum (illustration) is carbon. These lines, with one exception, are impurities in the carbon. It is difficult to get carbon free from certain metals.

The next (illustration) is that of iron, and below that is a spectrum of iron using a high frequency current, about fifteen or eighteen thousand volts. The lines further out are more intense, due to certain ionization effects. Below that is a spectrum of tool steel. The spectra we find here is from a G. E. health light. Please note that it is quite dense in the visible and extends out into the ultraviolet. Below that, for comparison, we have the mercury vapor lamp, a very heavy line at this place

and considerable radiation, of course, extending well out in the ultraviolet. Below is a spectrum of a photo flood lamp, an illuminant which is very useful in absorption work. I shall not discuss this evening this important phase of spectroscopy.

Slide No. 3. We have (the upper one) again the spectrum of iron, for reference, and below that one of pure nickel. Below that is a spectrum of a nickel electrode about 99 per cent. Then follows a 95-97 per cent nickel electrode and another 99 per cent, and finally this one which was considered a poor electrode.

I will not take time to point out the differences, but there is one electrode, the fourth from the bottom, which is of interest. You will see certain lines which are different and not found in the other nickel electrodes. This is an electrode twenty years old, and those lines (illustration) were found to be tin. There are other elements present in that particular electrode which we studied but are especially in evidence on this next slide, and it will also give an idea of how we go about identifying certain elements qualitatively.

Slide No. 4. From a preliminary study we suspected tin was present. Using the iron spectrum as a standard, we identified the lines and found them to be charteristic lines of tin. This (illustration) is the "unknown", and below that is the spectrum of tin. Please note that line (illustration) and how it carries through. This line (illustration) carries through. That (illustration) carries through, and so on. All of the prominent lines of tin carry through. That means there is tin in the sample. No other element or arrangement of elements will give lines exactly in these (illustration) positions. That proves positively the presence of tin.

In the next series we have in order the spectra of the "unknown", the twenty-year-old sample, the pure nickel, and finally silicon. We wanted to check up on the presence of silicon. We found that it carried through into the sample. There is an appreciable amount of silicon present, as shown by this group of lines.

Let us consider the case of iron. This (illustration) shows the number of iron lines which carry through. The last one in this series is magnesium. This (illustration) is the very intense line of magnesium. Take the group of five lines (illustration), the middle one of which is probably thirty per cent brighter than

the doublet on either side and probably hard for you to see, but it does carry through, showing there is a certain small amount of magnesium present.

Slide No. 5. This represents a study of a sample of a nickel solution which had given trouble. We anticipated the presence of zinc. These (illustration) are characteristic zinc lines. They did not carry through. The operator suspected the presence of a small amount of zinc, but we were able to say quickly, "Zinc absent". Those lines (illustration) are copper, and I am sorry I cannot show on account of the low intensity that they do carry through. We found copper in an appreciable amount. These (illustration) are lines of chromium. They did not carry through, proving the absence of chromium.

Slide No. 6. By taking a "snapshot" one can tell at a glance what is present or absent in small amounts. (See illustration No. 6 of tellurium in lead.)

So much for the qualitative aspects of this work. Let us consider a quantitative problem. This (illustration) is an alloy of lead containing a very small amount of tellurium. We have used carbon electrodes. That is what you see in this (illustration) portion. Note these bands coming to a head. These (illustration) are lead lines until we get to this point. This is a carbon line. Here are two tellurium lines. You have observed how they carried through, gradually fading out. We made a series of exposures of lead tellurium alloys with varying amounts of tellurium. They fade from .31 per cent down to .054 per cent. We can barely see them at this distance from the screen. Using a magnifying lens we can readily observe gradations. The gradations represent differences of only five-thousandths of a per cent. If we had an "unknown" we would place it in between these samples and find out, using this set of standards, where it would fit in.

Slide No. 7. I have here a slide that illustrates a method of analysis by the use of limits, but I believe I will not show it because it does not represent anything especially new.

Slide No. 8 Here is the case of a regular nickel solution containing thirty-two ounces of single salt to the gallon and in addition very small amounts of cadmium. These heavy lines are characteristic of cadmium. This spectrum contains fourteen hundred milligrams of cadmium per liter; this, 700 milligrams;

this, 350; this, 200, and finally 50. But those heavy lines are not the best lines. Heaviest lines are often not the best lines with which to work. Sometimes a light line, like this, (illustration) is more persistent. We see it carries through and does not fade, but let us examine some of the others.

Consider this line at 3,261.05 Angstrom units. It is quite intense, and fades out gradually. There is a small amount representing fifty milligrams, and from fifty it goes to zero. The intensity of those lines represents very definite amounts of cadmium present. If one is interested in some particular range for smaller amounts, he can make up a new set of standards covering that particular range and get gradations as small as five-thousandths of a per cent.

Slide No. 9. The case of iron. It is a much harder one, and we haven't an approved technique worked out. At about 2,600 Angstrom units is a doublet which is rather difficult to show here; using a densitometer it can be easily seen. Another group at 3,100 is fairly good, but it is a little too near the nickel line and is crowded out by the nickel line.

Slide No. 10. The case of zinc in a nickel solution, in amounts varying from zero, in fifty milligrams steps up to and including 350 milligrams per liter of the regular nickel solution, has been the subject of a considerable amount of investigational work. This is the line which is usually recommended for the determination of zinc. It does not show up on the screen as well as under a lens, but it does distinctly show gradations. Those of you investigating this problem probably have noticed how the zinc line fades out and the nickel line very near may seem to reappear.

When measured on a densitometer, this nickel line (illustration) is found to be constant in intensity in each case; its apparent increase is only an optical illusion. Just a few millimeters to the left, the zinc line is seen fading out and the nickel line is apparently coming in. By taking advantage of the gradation, one can determine the amount of zinc very accurately.

Slide No. 11. In the case of copper in a nickel solution, there are two copper lines which we may use, at 3,273.96 and 3,247.55 Angstrom units. This spectra of copper is really a snapshot to bring out these (illustration) two lines as markers. They are the heavy characteristic lines of copper. That heavy

line (illustration) corresponds to 200 milligrams of copper in a liter of solution. The next one to twenty milligrams and then two milligrams, and finally the last, one of unknown strength. You can see it is greater than the two-milligram sample and smaller than the twenty. We need a different set of standards of smaller gradations to determine that amount within a few milligrams.

Slide No. 12. In the last few slides I showed nickel, zinc and so on, separately, but in actual routine work one would proceed differently. One exposure would be sufficient to determine the cadmium, copper, zinc and iron.

Slide No. 13. Studies like the above may be extended to alloys. This is a spectrogram of a die casting of a zinc base, and the upper one where you see the dot, such as that, and that, represents aluminum. Those are lines of aluminum in zinc. The next are the characteristic zinc lines which finally fade out; copper shows up here at the wave lengths already mentioned. Here are the characteristic magnesium lines that fade out as the amount varies, and this is a very heavy magnesium line.

Slide No. 14. Finally, I will show this slide to represent another method. We have taken various lines and measured the intensity. This method is based upon the measurement of the length of the line. The trouble with this method is that it is very difficult to decide exactly where these lines terminate. Their length is a function of the amount of material present.

In conclusion, I would again say that spectrographic methods are very special. They apply especially to the cases where only very small amounts, which usually we would refer to as impurities are present. Furthermore, besides the application to routine analytical procedures, these methods may be used, as very valuable tools in research laboratories in investigation, for example, of the composition of a pit in a nickel deposit. (We usually have found some iron present in pits.) One can study the composition of these defects in deposits, or certain portions of a deposit, without dissolving the metal. When necessary, we can take only a few milligrams for an analysis.

Another use of the spectrograph is for the study of segregated crystals in the surface of a metal. By placing a miniature electrode above a selected portion of a surface whose composition is desired, one may obtain a spark spectrum and find at least

qualitatively the composition of segregated portions of the surface.

CHAIRMAN BLUM: I am again in the position that I referred to at the Faraday Society. We simply have too many good papers to permit adequate discussion of them. In spite of the lateness of the hour and the fact that you folks are all so patient and interested, I can tell that from your continued attendance, I am going to allow a few minutes for any questions you may wish to ask Dr. Ewing.

MR. PROMISEL: May I ask what type of photographic plate was used in this case?

DR. EWING: All of these plates, I believe, are Eastman 33. We have found that polychrome plates are very good for certain work.

MR. PROMISEL: What technique did you use in analyzing the plating solutions? Did you use it in liquid form or evaporated form?

DR. EWING: We placed about a tenth of a millimeter of the solution on the crater of the lower carbon electrode, evaporated it, dried the residue at 120° and arced it for thirty seconds.

DELEGATE WOOD: Does that mean you can do the whole process after you have prepared your arc in that time?

DR. EWING: The exposure was made in thirty seconds. Then follows the operation of developing the plate—seven or eight minutes—and finally the study of the plate after it is prepared.

Some of My Experiences in High Current *Density in* Nickel Plating

By MR. PAUL AMUNDSEN
Chief Chemical Engineer
of PARKER-WOLVERINE Co.
Detroit, Mich.

Paper Read at May Meeting of Detroit Branch

THE practical application of the deposition of nickel at high rates has always been very intriguing to me. By high rates I do not necessarily refer to high current densities so much as the amount of nickel actually deposited per unit time, it being entirely possible to deposit less nickel at 95 than at 65 amp. per sq. ft. although using fairly good plant practice in either case.

At this point we should define just how we would determine the current density we are using. Let us assume that at a particular point on some object that has been plated but not buffed, we find .001 inch of nickel and that the plating time has been 20 minutes. We know then, that the current density has been at this point approximately 1240/20 or 62 amperes per sq. ft. If the particular solution that we had used will permit 95% of the current to deposit nickel metal under the same conditions, we may divide 62/.95 and obtain slightly over 65 amp. per sq. ft. This latter figure is very close to the actual current density at the point in question. If, now, the great bulk of the nickel plate on the significant surfaces is .001 of an inch, we would say that we are plating at 65 amp. per sq. ft. I would say at this point, that if the specifications called for a minimum thickness of .0010" that the above object would have been unsatisfactorily plated. The point of minimum thickness might be .0009" or less and we would expect to buff away a certain amount so that the thickness of nickel on the great bulk of the significant surfaces would probably have to be between .0011 and .0012 inch.

The deposition of nickel at high current densities has certain definite advantages. By high current densities I mean for example, current concentrations of from about 65 to 100 amp. per sq. ft. on significant surfaces, as I believe that these are higher than is usual in average plant production.

All plating plants are limited by their walls or the boundaries whatever they might be, that contain it. If an increase in production is desirable to obtain lower operating costs the best solution perhaps is not the construction of another unit or plant outside of these walls or boundaries but a slight change to enable a higher rate of deposition to be used might be very desirable. If the overhead is but slightly increased for the entire shop there will not only be a greater net profit due to the greater number of pieces plated but a greater profit per piece will result. There is no doubt, that in addition to the smaller floor space required that there is a considerably lower inventory of solutions, tanks and anodes required, also the work moves more rapidly through the plant. This low inventory of equipment means that a plant is more flexible. If any benefits may result from a rearrangement this may be more easily accomplished.

A nickel plating room of limited size is used to its best advantage when current densities are high and the plant is so laid out that each man has to take the least possible number of steps and do the least possible amount of work to successfully accomplish his job. By least possible amount of work I mean for example that the plater should not have to handle a load of over 15 pounds at any one time if possible, he should not have to raise a load any higher than is necessary, or avoid obstructions when walking, or have to be unduly careful because of slippery floors.

The deposition of nickel at the higher rates offers no especially difficult problems beyond those encounters in plating at the more moderate rates. In general, the problems are merely more intensified because of the fact that solutions tend to change composition more rapidly, the anodes dissolve very rapidly and any exposed parts of the racks are built up very heavily in a short time. Also the electrical connects must be so constructed that the current will be carried with the minimum of potential drop.

In order to take advantage of the possibilities of the use of higher current densities it is necessary to recognize certain facts.

First of all the nickel must be distributed as well over the piece as is possible. It does no good to pile on a heavy poundage of metal very quickly if the distribution is poor and there is a wastage on certain points and a deficiency at others. Where there is a heavy production of certain pieces a careful study of the method of suspending these in the tanks must be made and the racks designed accordingly.

There is perhaps no much more important phase of plating control than the design and spacing of plating racks. The work should be racked in such a manner that the normally high current density areas are shielded from receiving too much current in some manner. This can most often be accomplished by allowing the points, edges, or corners of adjacent pieces to shield each other. If the pieces are long and plated horizontally the anodes opposite the ends may be removed or shifted toward the center. In this manner better distribution of the current is accomplished and a higher rate of plating becomes a fact. It is necessary of course to be sure that the electrical connections

are positive so that all of the pieces receive their proper share of the current.

No one likes to have an excess of plate on one piece and a deficiency on another although the average current on the two may be correct. If this condition exists and it very often does if we are not careful, we must use a low enough average current density on the two pieces so that the one receiving the higher current will not be burned. In this latter case the individual pieces are not only unsatisfactory but the rate of plating could be higher.

The distribution length and length of anodes must be carefully considered, inasmuch as there is a considerable polarization or its equivalent in resistance at the interface between anodes and solution. It is necessary to keep the tanks well stocked with anodes if we are to keep our voltage as low as possible and get the maximum from the motor generator set. If the effective anodes are not closely spaced or their connections to the anode rod made positive, some of the work will receive more than their share of current and a lower average current made necessary. The most disturbing thing, however, about this condition is that the product is non uniform.

Anodes should be of the proper length or should we say that the work should be of the proper length for the anodes. Current does not tend to flow in straight lines from anode to cathode or in the opposite direction whichever way you think of it, but the lines of travel tend to spread out because of their sameness of polarity. This tends to crowd the current to the lower end of the rack of work giving an excess of current density there. This may be offset to a great extent by varying either the cathode or anode length. For average work you will probably want to have the anodes somewhat shorter than the work or if plating an object that has its largest surface near the bottom the anode probably should be a little longer. By using proper anode lengths the work will not only receive a more uniform deposit of metal but the anodes will corrode more uniformly. This avoids cutting off of the anode by the current and having two wasted ends instead of one, in addition to obtaining a more uniform plate from top to bottom of the rack or object.

We of course all know of the necessity to obtain the economics

and more uniform deposits resulting through the use of well insulated racks.

I have attempted thus far to stress the importance of obtaining a uniformly heavy deposit not only on the same piece but on different pieces in the same tank as this is especially important when plating at a high rate.

Since the cost of buffing the deposit obtained in the plating room is considerable and very much dependent on the type of plate obtained there, a high speed plating process must yield a deposit very easy to color. This means that the deposit must be level and of the proper structure to buff readily. This condition is readily obtained at high current densities.

When plating nickel at high rates we are mostly concerned with the problem of getting nickel ions to the work fast enough and maintaining the pH of the solution film next to the cathode high enough to obtain a good efficiency and low enough to prevent the formation of basic salts or oxides. Nickel ions have been shown to migrate quite sluggishly through a solution. If we attempt to plate too rapidly the nickel ions do not get to the cathode surface rapidly enough, the efficiency falls off and basic salts deposit producing a black, rough deposit worthless for protective purposes. In fact if the current density is high enough no nickel as such will be deposited only green salts. You have probably seen this condition many times on the ends of wires that have projected out toward the anodes. Anything that will tend to aid the nickel ions to reach the cathode more readily or maintain a lower pH of the cathode film will serve to lessen this condition and permit faster plating. From this we know that a higher temperature, higher concentration of nickel metal ions, agitation of the cathode or lower pH will result in ability to plate faster. The presence of boric acid aids in preventing this burning by keeping the cathode film more acid. Ammonia in small amounts helps to keep these basic nickel salts in solution so that they do not deposit as such and cause burning but it also tends to keep the nickel ion concentration lower which is not desirable for fast plating. Higher temperatures may be feasable in some instances, but in general are not necessary. A high nickel metal content certainly is not economical. Mild agitation of the cathode certainly is feasable and very beneficial

as regards ease of buffing and the higher current density possible. This type of agitation tends to prevent the solution from striating during use without stirring up any foreign particles at the bottom of the tank.

We have arrived at a metal concentration amounting to approximately 7 oz. per gal. in an agitated solution and 9 or 10 in one not agitated. This is a moderate amount, does not permit a very high dragout loss and gives a very efficient solution.

The chloride content that we have found to be best is about 5 oz. per gallon of nickel chloride in a high speed solution if the pH is above 5 and higher if the pH is lower. A considerably smaller amount of chloride will permit excellent anode corrosion but it does have a very beneficial effect on the structure of the deposit.

The boric acid is maintained at about 4 oz. per gallon.

We have two types of solution, both agitated, one run at a pH of about 2 or slightly lower and the other at a pH of 5.3 both electrometric and strangely enough are able to plate a .001 inch of nickel from either one in 18 minutes commercially with good results and have done it for a period of a year or more. The deposits are very ductile, light in appearance and easy to buff.

I will say that although we obtain an excellent deposit from the high pH solution if the solution is agitated the deposit is worthless if we attempt to use the above conditions if the work is not agitated.

There is no doubt that plating under high pressure in a comparitively small volume of solution tends to cause the solution to change composition quite rapidly. We use 3 amp/gal of solution and usual practice is I believe about -1 to 1 amp/gal. For this reason practically all of our production is run through the low pH solution as there we can obtain practically all of our nickel metal content from the anodes and the addition of sulphuric acid. Thus we have to replenish these tanks only with small amounts of boric acid and nickel chloride and occasionally nickel sulphate.

I would like to leave this thought with you that the ability to plate rapidly and well is about as much a function of careful rack and equipment design as it is of solution control.

The Abstract Section

PATRICK J. SHEEHAN, *Chairman, Program and Educational Committee*

Defects in Chromium Plating, A. DARLAY, *Galvano*, Feb. 1936, page 20—In concluding a listing and discussion of defects encountered in chromium plating, the author finds most of them due to the sulfuric acid or to the trivalent chromium content of the bath. To keep down the trivalent chromium he recommends that the bath be not worked when weak, that a large anode area be used, that the work be degreased in an electrolytic cleaner, that rinse water be not added to the bath, and that the tank insulation be checked occasionally. Reference is made to the porous-pot method of eliminating trivalent chromium. C. T. THOMAS.

The Deposition of Alloys, CHAS. BECHARD. *Bull. Soc. Fr. des Electriciens*, Feb. 1936, p. 209—A bath containing proper proportions of potassium stannate and potassium cuprocyanide is recommended for the deposition of bronze. It should be operated warm and with agitation. The author recommends separate anodes of copper and tin, used with resistances to permit control of the proportions of these metals going into solution, rather than the usual method of using alloy anodes. C. T. THOMAS.

The Atmospheric Rusting of Iron ("Über das Atmosphärische Rosten des Eisens) by GERHARD SCHIKORR, *Zeitschrift für Elektrochemie und angewandte physikalische Chemie*, Vol. **42,** No. 3, 1936, pages 107 - 113—The effects of various external conditions were studied for the rate of atmospheric rusting of ingot iron. Panels were exposed every month from November 1933 to December 1935 on the roof of the Materialprüfungsamt in Berlin. No simple relationship between rusting and the amount of rainfall was found but a regular relationship was determined for the rate of rusting and the relative humidity. When the relative humidity was over 70%, rusting occurred even in the absence of liquid water (dry rust). Dry rust occurred if dust or previously formed rust was on the panel and laboratory tests showed that rusting occurred under these conditions at 93% humidity, less at 83% and no further rusting at 62% humidity. The rust film present on the surface may have an accelerating effect on the rate of corrosion initially but may later retard the rate of corrosion after the film has become thicker and much less permeable to moisture and traces of acids in the atmosphere. These experiments add further evidence to the many previous observations that moisture, oxygen, and traces of acids cause rapid corrosion of iron.

WALTER R. MEYER.

Rhodium Plating (Galvanische Rhodinierung) Anonymous *Oberflächentechnik*, Vol. **13**, No. 5, 1936, pages 53 - 54—Rhodium belongs to the metals of the platinum group and costs about 4.50 RM per gram ($34 an ounce) against 3.50 RM per gram ($26 an ounce) for platinum. Thin coatings of rhodium (1 gram per square meter) are used over silver plated jewlery because the coating is not darkened by sulphur or most corrosive substances. In fact, rhodium is more noble than platinum and it is not attacked by single acids or aqua regia. The reflectivity of rhodium for light of wave lengths from 4000 to 7000 Angstrom units is superior to chromium, nickel, and platinum but is 10% less efficient than bright silver. Silver tarnishes readily and its reflectivity may drop well below that of rhodium. Rhodium is harder than silver, gold, and nickel and somewhat softer than chromium. The baths for the deposition of rhodium (composition not stated) have high cathodic efficiencies approximately 90% operate at room temperature, and have excellent throwing power. Platinum anodes and pyrex glass tanks are recommended. Very low current densities are employed but this does not prove to be detrimental because a sufficiently thick deposit can be obtained at 2 amperes per square foot in from 5 to 6 minues. WALTER R. MEYER.

Electrolytic Process of Polishing Metallic Surfaces—The usual method of polishing metallic surfaces is to use abrasives of successively increasing fineness. An electrolytic method gives greatly superior results. The metal to be polished is immersed as anode in an aqueous solution containing per liter at least 400 grams of PO^4H^3 or $P^2\ 0^7\ H^4$ and maintained at a temperature of from 15° to 20° C. For example in producing polished surfaces on copper, the cathode is a sheet of copper with a larger surface than that of the anode. A sensitive voltmeter measures the difference of potential between these two electrodes. A feature of the process relates to providing an irregular but characteristic change in voltage with increasing current. When certain relations are maintained between volts and amperes (by resistance adjustments) the anode surface becomes smooth and lustrous. Gaseous bubbles appear at the anode. The appropriate values of voltage and current depend on the concentration of the solution, on the ratio of the two surfaces and on their spacing and position; the most effective current being least when the anode surface to be polished is horizontal and located below the cathode. The best results are obtained by using filtered solutions and eliminating the initial bubbles which sometimes appear on the surface when the metal is first immersed. Microscopic inspection of the polish obtained by Jacquet's electrolytic process reveal a quality far superior than that obtained by mechanical polishing methods. M. P. Jacquet. Laboratoire de Mecanique de la Faculte des Sciences 96, Boulevard Raspail. PARIS (6°). P. J. SHEEHAN.

1. Improved Solvent Degreasing—M. B. PICKETT—*Metal Cleaning and Finishing*—March, 1936, pp. 113-117—Discussion is given about modern solvent degreasing methods and equipment. Most of liquids used are non-inflammable, chlorinated hydrocarbons, having a low boiling point and low surface tension for rapid penetration. Degreasing machines may be either the straight vapor machines used on large parts, the boiler liquid-vapor type for screw machine products, or the hot liquid, cold liquid vapor type for light gauge parts, or closely nested parts. Hand operated degreasers are equipped with facilities for distilling the solvents from one tank to another. For large production, automatic degreasers with a conveyor belt and continuous still are used.

PHIL J. RITZENTHALER.

2. Abrasive Sleeve Polishing Wheels—FRED B. JACOBS—*Metal Cleaning & Finishing*—March, 1936, 121-127—The abrasive sleeve polishing wheels are finding increased use in industrial polishing today, as they are cheaper and more quickly "set up" than the conventional glued wheels.

Newest types of sleeves are lap-less; that is, have no seam to interfere, and are made in all grades of emery from finest polishing down to coarse cutting wheels.

The appliances for holding these sleeves on the wheels vary from expanding rubber drums on a metal plate, jamming the rubber tight, to an air inflated polishing wheel.

Best speeds are 900-1800 R.P.M. on soft metals or 1500-3600 R.P.M. on hard metals.

A new production method of applying the abrasive grains so that they assume correct position involves the use of electrostatic action whereby abrasive under 100,000 volts is caused to arrange itself with grains up where they exert maximum cutting effect.

PHIL J. RITZENTHALER.

3. Gold Control in Electrogilding—J. B. KUSHNER, Ch. E.—*Metal Cleaning & Finishing*, March, 1936—pp. 117-120—Article gives methods for gold control in gold plating so as to insure minimum cost and maximum usage of gold stocks. Gold solution of known composition is kept and additions made from it, keeping records of its use. Work is weighed before and after plating to find weight of gold deposited. Racks are also coated to avoid gold waste. Rinse water is used as make up for the bath so as to minimize dragout.

PHIL J. RITZENTHALER.

MEMBERSHIP OF BRIDGEPORT BRANCH

	Active	*Assoc.*	*Hon.*	*Total*
Membership report of May 31, 1935	47	21	1	69
Members elected during 1935-36	4	6	0	10
Members rec'd by transfer	0	1	0	1
Suspended members reinstated	0	1	0	1
Total	51	29	1	81
Deduct from above totals—				
Members suspended in 35-36	5	3		8
Members died 35-36	1	1		2
Members resigned	1	0		1
Members transferred to other Branches	0	1		1
Totals	7	5		12
Present membership May 31, 1936	44	24	1	69

Members Elected

John Harper	associate	H. L. Kellner	associate
F. B. Gotthardt	associate	R. J. Doucette	active
J. T. Sullivan	associate	E. A. Andrew	active
J. E. Charleson	associate	J. D. O'Connell	active
Meyer Freed	associate	Jos. Wenick	active

Members Suspended

Carmine Caruso	active	Chas. Trombetta	active
David Falsey	associate	Chas. Walsh	active
John Moker	associate	Salvatore Zanelli	active
Laurea Theriault	active	Wm. Peters	associate

Suspended Member Re-instated—Wm. Peters

Member resigned.....Wm. Kusterer

Members died.....Chas. Barbour, Dayton Lasher.

Member transferred to other Branch...I. D. Niles to Springfield Branch

Member received from Philadelphia Branch...John Yingling

CHARLES H. COSTELLO, *Sec.*

LOS ANGELES BRANCH

Minutes of the regular monthly meeting of the Los Angeles Branch A. E. S. held April 8th at the Rosslyn Hotel. President E. R. Williams presided. M. D. Rynkofs acted as secretary in the absence of Earl Coffin.

The minutes and financial report of the previous meeting were read and accepted.

Messrs. Ellis and Vivian, representing the Rex Mfg. Co. gave us an interesting demonstration of their new "Degreasing" machine.

The meeting was turned over to Ray Bray, the librarian, who found the following questions in the box:

Q. What is a good strip to remove nickel from zinc die castings?

A. Regular Sulphuric Acid strip, about 50 degrees Baume'.

Q. What causes nickel plate to come out of the tank rough?

A. Any number of things may cause this. Perhaps the solution got stirred up or the anodes were disturbed causing impurities to float around in the solution and settle on the work.

Q. Does the kind of water used in a nickel bath have anything to do with the nickel pitting?

This question was not definitely answered, although there was considerable discussion as to the causes of pitting.

EARL COFFIN, *Sec.-Treas.*

BINGHAMTON-ELMIRA BRANCH

Monday May 4th all members of the Binghamton-Elmira Branch were invited to attend a luncheon at the International Business Machine's Country Club House and then inspect the factory. Many members and visitors took advantage of this opportunity to look over this very modern plant and also partake of the wonderful cooking and enjoy the surroundings of their Club House.

In the evening at 6:30 we held our monthly meeting at the Y. M. C. A. Binghamton, N. Y. The meeting was open and an exceptionally good crowd was on hand to hear "Cyanide Bill" Schneider of R & H Chemicals, at his best talking about brass plating zinc base castings. His talk was very interesting and if results comparable to the samples he had on display can be produced in regular production he certainly has something. Bill informed us that some of his samples were seven years old and were not plated in a laboratory but in a plating room under ordinary conditions. Of course no one doubted Bill and we all believe he has a good idea to sell to the automotive industry.

During our business session we elected officers for the coming year and delegates to the Convention.

We decided to drop all members who failed to pay their dues the last quarter.

LARRY MEYER, *Sec.-Treas.*

HARTFORD BRANCH

The Hartford Branch held its regular monthly meeting on Monday evening, May 11, 1936, at the State Trade School, Hartford, Conn.

The meeting was called to order at 8:30 P. M., with President St. Pierre

in the chair. Minutes of the previous meeting were read and accepted. All communications were read and placed on file. No bills were presented. One new member was elected.

Delegates and alternates were duly elected, also instructed how to vote on certain questions.

Office election also took place and the following members were elected to serve for the year 1936-1937:

President, Mr. Charles W. Peterson; Vice-President, Mr. W. H. Lamie; Sec.-Treas, Mr. V. E. Grant; Librarian, Mr. W. E. Bancroft; Board of Managers, Mr. H. R. MacFadyen, Mr. Jos. St. Pierre, Mr. Apley N. Austin.

At this meeting, one member was granted a transfer to the Waterbury Branch, the member being Mr. C. R. Prescott.

One member's, Mr. P. J. Beloin, resignation was accepted.

The following active members were suspended for non-payment of dues:

Mr. Fred Carlton, Mr. C. M. Hastie, Mr. N. Masesian, and Mr. A. W. Westerberg.

The meeting was attended by only twelve members and was adjourned at 9:45 P. M.

V. E. GRANT, *Sec'y.*

GRAND RAPIDS BRANCH

The regular monthly meeting of the Grand Rapids Branch was held May 14, 1936, with a good attendance.

The following members were elected to office:

President, Mr. Homer Morton; Vice-President, Mr. John Carlson; Sec.-Treas, Chas. S. Whalley; Librarian, Mr. Collins; Board of Managers, Mr. Chas. O. Werft, Mr. Axel Rickson, Mr. Frank Ver-Plank.

CHAS. S. WHALLEY, *Sec.-Treas.*

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WATERBURY BRANCH

Waterbury Branch, A. E. S., held its annual meeting Friday evening, May 8th, in Engineer's Hall. Tennant Elwin, president, presided. Communications from the supreme secretary-treasurer, accompanied by the proposed amendments to the Constitution, were received and read. Announcement was read from New York Branch, stating that it was in the field for the 1937 Convention. A letter relative to the same subject was received from the New York Convention and Visitors Bureau. Application for associate membership was received from George Andrew Colombie, of the Torrington Co. The election of officers for the ensuing year resulted as follows: President, Tennant Elwin; Vice-President, William Cavanaugh; Sec'y-Treas. William F. Guilfoile; Librarian, Ells-

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worth Candee; Board of Managers, William J. Gray, Sept. Marland, and Richard Crane. Delegates to the Convention, Wm. F. Guilfoile, Wm. J. Gray and Joseph McConas; alternates, Andrew Perrin, Leroy Miller, and William Cavanaugh. At the conclusion of the election, discussion in regard to what action the Branch and its delegates should take relative to the proposed amendments. At the conclusion of the business session, President Elwin called upon Mr. George Hogaboom for his annual address to the Branch. George is no stranger in this city, having been the founder and first president of the local society. Taking for his subject, "The Protective Coatings for Metals"the speaker delivered an interesting discourse that embodied a variety of subjects. He spoke on the shortage of cadmium and the research that was being made to secure a suitable substitute in the bright zinc solutions. Exposure tests and accelerated tests received the speakers attention, as did also the zinc and cadmium comparisons. The talk proved to be interesting and instructive and was enjoyed by the local and out of town members and friends, who gave George a rising vote of thanks.

W. F. GUILFOILE, *Secy.*

CHICAGO BRANCH

The regular monthly meeting of Chicago Branch was held May 9, 1936, at the Atlantic Hotel, President F. Herbst presiding, and all other officers present.

Mr. F. P. Cisco and Mr. F. E. Bless were elected to active membership.

The new proposed Amendments to the constitution were read and discussed and this matter referred to our Delegates.

Mr. H. A. Gilbertson reported the trains and rates to the Cleveland convention and urged all those that could possibly attend to be sure and go to this convention.

The subject of a joint Picnic for Chicago and Milwaukee Branches was discussed and Mr. J. Hay and Mr. O. E. Servis were appointed as a committee to meet with the Milwaukee Branch committee and decide on a suitable grove to hold same.

The following officers were elected for the coming fiscal year: Mr. G. Jelinek, President; Mr. M. H. Longfield, Vice-President; J. W. Hanlon, Secretary-Treasurer; Mr. O. E. Servis, Librarian; Mr. W. Meggers, Mr. H. Gillis, Mr. G. Holgrem, Board of Managers.

Delegates to the convention: F. J. Hanlon, O. E. Servis, J. W. Hanlon. Alternates, Mr. H. A. Gilbertson, Mr. M. H. Longfield.

The librarian found the following questions in the question box:

No. 1. *How long a time in hours of operation should an electric cleaner be used before dumping; volume of work varies but estimate the cleaner works* 20 *minutes per hour?*

Answer. Depends on the nature of the work, on the size of the cleaner, the amount of drag out, etc. It was suggested that the cleaner should be dumped at least four or five times per year.

No. 2. *What is a good copper strip for zinc base die castings?*

Answer. Cyanide solution with reverse current.

No. 3. *Should a lead lined tank be used for chrome drag out tank where the drag out is returned to the chrome solution to replenishing?*

Answer. An iron tank will be just as good and cost less.

No. 4. *What action takes place in a nickel solution that contains sodium sulphate if you plate parts that have brass and zinc die casting on the same part?*

Answer. The sodium sulphate will not be harmful to the brass, and will help the throwing power.

No. 5. *What is a good chrome strip that will not leave any chrome oxide on the work?*

Answer. A mild caustic solution with reverse current or a cyanide solution with reverse current.

No. 6. *What makes a chrome solution look thick and sluggish at* 110% *although it plates O. K.?*

Answer. It may be a very dense solution or have a lot of sludge at the bottom and when it is stirred up makes the solution look thick and sluggish.

NEWARK BRANCH

The regular meeting of the Newark Branch A. E. S. was held on Friday Evening, April 17, 1936, at the Hotel Douglas, Hill St., Newark. The meeting was called to order at 8:30 P. M. by Vice-President John Kotches. President Samuel Taylor came in later on and allowed Vice-President John Kotches to continue with the meeting for the rest of the evening. The following officers were present: Samuel Taylor, President; John Kotches, Vice-President; George Wagner, Secretary; Nelson Sievering, Treasurer; George Klink, Sergeant-at-Arms; Cyril Hamlin and Sam Glickenhaus, Trustees.

The minutes of the previous meeting were read and approved. Mr. Horace Smith, chairman of the Banquet Committee, received some prizes for the Bingo Games, to be played at the Banquet, from some of the members. Mr. Smith introduced two visitors, Mr. Kolb and Mr. Kohlmeier from Roches-

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ter Branch, and at the same time called on them for a few remarks.

Mr. Hy asked about removing black scale from small steel parts and was told that tumbling in a wood barrel in a 10% Hydrochloric Acid Solution for 5 hours, then burnished in soap and steel shot for 2 hours would do the job satisfactorily.

Meeting adjourned at 10:30 P. M.

The regular meeting of the Newark Branch A. E. S. was held on Friday Evening, May 1st, at the Hotel Douglas, Hill St., Newark. The meeting was called to order at 8 P. M. by President Samuel Taylor. The following officers were present: Samuel Taylor, President; John Kotches, Vice-President; George Wagner, Secretary; Nelson Sievering, Treasurer; Cyril Hamlin and Samuel Glickenhaus, Trustees. The minutes of the previous meeting were read and approved.

Mr. Horace Smith, Chairman of the Banquet Committee, reported that the Banquet, which was held on April 18th, was a huge success both socially and financially and stated that the Bingo Games, played at that affair, were greatly enjoyed by all who were present. Mr. Smith was given a vote of applause for his interest and sincerity in handling our annual affair.

The Newark Branch elected the following delegates to the convention which is scheduled to be held in Cleveland, beginning Monday June 1st: Mr. Horace Smith, Mr. Nelson Sievering, and Mr. Cyril Hamlin. The following members were elected as alternates: Mr. Robert Sinclair, Mr. Philip Sievering, and Mr. Samuel Taylor.

The meeting adjourned at 10:30 P. M.

GEORGE WAGNER, *Secy.*

BOSTON BRANCH

Boston Branch met Thursday, May 7th, at the Squantum Yacht Club with President Wood in the Chair.

Some sixty members and their friends sat down to a chowder supper prepared by our new President Mr. Arthur J. Mintie and everybody had a fine time. A rising vote of thanks was given Mr. Mintie for the fine evening of fun and entertainment.

After this, the regular order of business took place—minutes of the previous meeting, communications, and bills read and approved.

The following applications were approved by the Board of Managers, and were elected to membership: Leo A. Donavan, Wallace B. Rideout, Robert Port, Stanley S. Knight, Frederick C. Dykerman, James W. Shaw, Jr., and Carroll C. Swift.

The following applications were read for the first time and turned over to the Board of Managers: Charles E. Barber, Joseph M. Hauber, Charles Hall, Wesley Colby, Floyd S. Ray, Thomas J. Gilmartin, Laurence Tosi, Thomas Palmer, Arthur H. Eriksen, William Lawrence, Isadore Baker, Herbert J. Quigley, Edward F. Foster, and J. Arthur Zimmer.

Mr. Mintie, Chairman of the Outing Committee, made a report on the coming Outing of the Branch. It will be held July 25th at the Pemberton Inn, Hull. This is near Nantasket Beach. He has asked that every member try and make it a success, a great time for all.

Boston Branch is very sorry to hear that our good timer Francis Mackie, our first President, has been sick and the Branch hopes to see him up and around soon.

The following delegates were elected to attend the 1936 convention to be

held at Cleveland June 1st: Donald Wood, Charles O. Hardy, and John F. Harney. Alternates E. V. Buckley, Louis A. Gale, and A. W. Garrett.

The election of officers for the coming year are as follows: President, Arthur J. Mintie, Vice-President, Edward C. DeLorme; Sec'y-Treasurer, A. W. Garrett; Librarian, Elton V. Buckley; Sergeant-at-Arms, Bert Sage; Board of Managers, Chairman Donald Wood, Charles F. Campbell, and Louis A. Gale.

We had with us Mr. Frank Clark of Springfield Branch and he installed our President, Mr. Mintie, and all the new officers of the Branch. A vote of thanks was given the retiring officers for the good work they had done the past year.

We had two speakers for the evening and the first was Mr. Edward C. DeLorme of the Holzer, Cabot Co. He gave a very interesting talk on the "Coloring and Bronzing of Metals". He explained how this work is done and showed some very interesting samples which he passed around. He answered all questions and a rising vote of thanks was given him for his very fine talk. He is a member of Boston Branch.

Our next speaker was Mr. William Jones of the United Carr Fastener Corp., also a member of our Branch. He spoke on "Chrome Plating" and he also explained how this work is done by him both in the still and barrel plating. He showed a great many samples and these were passed around for the members to look over. He answered all questions for the members and was also given a rising vote of thanks for his very interesting talk.

The meeting adjourned at 10:30 P. M.

A. W. GARRETT, *Secy.*

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BRIDGEPORT BRANCH

The May meeting of the Bridgeport Branch was held on May 1, 1936. There were forty-two members present. After the reading of the minutes, and there being no committee reports, the meeting proceeded to election of officers for the fiscal year 1936-1937.

Mr. Wm. Bridgett of Wallingford, was elected President after he and Mr. Wm. Ehrencrona were nominated. Mr. Ehrencrona declined to run, and the Secretary was instructed to cast one ballot for Bill Bridgett as President.

Joe Sterling and Elmer Monson were nominated for Vice-President and Elmer Monson of Bridgeport, was elected. The tellers were the sponsers of the nominees, Ray O'Conner and Al Rosenthal.

Charles Costello and Walter Meyer were elected to continue in office as

Secretary-Treasurer and Librarian respectively by unanimous vote. Bill Flaherty accepted the post of Sergeant-at-Arms by acclamation.

The Board of Managers for 1937 will be John Oberender, Ben Kusterer and Wm. Stratton.

Delegates to the National Convention are Joe Downes, Ray O'Conner, and Walter Meyer; alternates are Joe Sexton, Wm. Bridgett, and George Wagstaff. All these men expect to attend the Convention in Cleveland.

The delegates were instructed to use their own discretion as to the place of the 1937 Convention after a communication from the New York Branch was read. The New York Branch wants the convention in 1937.

John Harper was elected to associate membership by a unanimous vote and introduced to the members.

A committee was appointed to take charge of Bridgeport's exhibit at the Convention. Joe Sexton, Ray O'Conner and the secretary will serve. Many of the members present offered to furnish articles for exhibition, and the Bridgeport Branch expects to make a good showing.

The delegates were instructed to use their discretion regarding the proposed amendments to the Constitution sponsored by the Baltimore-Washington Branch. The general opinion of the members was favorable to having a full time Secretary and Editor if a man could be found capable of handling the job for the amount suggested ($3000.00 a year).

The June meeting will be held on the second Friday of June. In order that we might comply with the constitution, new officers were installed at once, and a confirming installation party and shindig will be held in June after the convention. Ray O'Conner, Gene Phillips, Bill Flaherty, George Wagstaff, and George Karl are the committee in charge of the shindig.

After a rising vote of thanks to the officers of the past year, the meeting adjourned.

Officers for the year 1936-37 of the Bridgeport Branch: President, Wm. Bridgett, 286 Ward St., Wallingford, Conn.; Vice-President, Elmer Monson, 168 Pacific St., Bridgeport, Conn.; Sec.-Treas., Charles H. Costello, 1285 Boulevard, New Haven, Conn.; Librarian, Walter R. Meyer, 13 Winthrop Court, Milford, Conn.; Board of Managers, John Oberender, Benjamin Kusterer, and Wm. Stratton.

CHARLES H. COSTELLO, *Sec.-Treas.*

DETROIT BRANCH

A regular meeting of the American Electro-Platers' Society, Detroit Branch, was held in the Ivory Room, Hotel Statler, on Friday evening, May 1st, at 8:00 P. M.

The President, W. W. McCord, presided.

The minutes of the previous meeting were read and approved.

The following applications for membership were reported on favorably by the Board of Managers, and they were unanimously elected to membership:

Herbert William Kennedy, Grasselli Chemical Co., 1530 E. Hancock St., Detroit; George A. Meyers, Bruce Products Co., 5712 Twelfth St., Detroit; John Pearsall, 1136 Collingwood Ave., Detroit; William A. Wischol, 5836 Lincoln Ave., c/o Douglas & Lomason Co., Detroit; Samuel H. Douglass, c/o R. L. Reed Co., 2567 Parker Ave., Detroit; Matt Koch,

WANTED to buy for spot cash a mailing list of firms doing oxidizing. Potential users of McKeon's *Liquid Sulphur* "The Oxidizing Agent of Today". — Sulphur Products Co., Inc., Greensburg, Pa.

Canadian Motor Lamp Co., 1246 Benjamin Ave., Windsor, Ont.

The secretary then read a letter from the Supreme Secretary and a copy of a proposed Amendment to the Constitution regarding the combining of the offices of Secretary-Treasurer and Editor on a full time basis with a salary. There was quite a discussion regarding this. It was moved and seconded that the delegates to the Convention be instructed to vote "No" on this amendment, but the motion was lost. Then it was moved and seconded that no instructions be given the Detroit Branch delegates on this matter, but they were to be governed wholly by their judgment at the Convention. Motion carried.

A letter was read from the New York Branch asking the co-operation of Detroit Branch at the Cleveland Convention in favoring the City of New York for the Convention of 1937. The motion, duly made, seconded and carried, that the Detroit delegates to the Convention use their own judgment at the Convention in this regard, followed.

The next order of business was the election of officers. For President, A. B. Wilson was unanimously elected by acclamation. For Vice-President, Geo. Kutzen was also elected by acclamation. For Secretary-Treasurer, T. C. Eichstaedt also elected by acclamation. For Librarian, B. F. Lewis was elected. For the Board of Managers: W. W. McCord, Charles Beaubien, and Eric G. Sampson, Jr. For delegates to the Convention: W. W. McCord, T. C. Eichstaedt, and A. B. Wilson; Alternates, George Kutzen, Carl Heussner, and L. P. Brockway.

After the election was held, Mr. Paul Amundson, a member of the Detroit Branch, who is Chief Engineer of the Parker-Wolverine Company, read a paper on "Some of My Experiences in High Current Density in Nickel Plating". This paper was very well read and interesting. It was very instructive and there were quite a lot of questions asked Mr. Amundsen after he finished his paper. The discussion brought out more then the paper in itself. This paper will be published in a later issue of the REVIEW.

After the discussion closed, the Board of Managers made a report stating that they had audited the Secretary-Treasurer's books and found them correct.

Mr. W. W. McCord then gave a very interesting talk on his experience as President of the Society during the past year. He thanked all the members and officers for their hearty co-operation. He also brought out the names of Mr. Charles Beaubien and Mr. Chas. Eldridge as having been very loyal in their support. In fact he stressed the point that had it not been for the thorough work of these two men, the meetings would not have been half as good as they were during the year. Mr. Eldridge as Chairman of the Program Committee took care of having some instructive, educational feature for every meeting. Mr. Beaubien as a member of the Board of Managers took care of checking bills, etc., with the Secretary-Treasurer, keeping all these bills off the floor and there was no discussion as to the whys and wherefores, as to which bills to be paid and which not, etc., making the operations that much smoother. All in all Mr. McCord said that he had had a very pleasant year acting as President and hoped that the following President would have even a better time.

Then followed the installation of officers, Mr. Charles Marker acting as Installing Officer. After the installation, Mr. A. B. Wilson took the

Chair and he gave a little talk, not as to what he expected to do, but what he expected the Society to do for him as President. He appointed W. W. McCord, Chairman of the Program Committee for the ensuing year, stating that Mr. McCord's experience for the past year should make it very much easier for himself.

Then followed a discussion regarding a picnic sometime this summer. It was discussed pro and con, and finally decided that we have a picnic, a formal motion being duly made, seconded and carried. Mr. A. B. Wilson appointed the Board of Managers as Picnic Committee and everybody to hold themselves ready for the announcement by the Committee as to when the picnic is to be held, to be sure that all members and their friends attend. This will be something new for the Detroit Branch and it is hoped it will be a real opportunity to get together, get acquainted and have an enjoyable time.

The Secretary's report on membership for the year showed that at the beginning of the fiscal year, June 1, 1935, we had 83 members, and at the present time we have 100 members. We had four resignations and one suspension, leaving a net gain of 17 members.

The meeting adjourned at 10:00 P. M., until the first Friday in September.

T. C. EICHSTAEDT, *Secy-Treas.*

CLEVELAND BRANCH

The regular monthly meeting of the American Electro-Platers' Society was held at Hotel Carter Saturday May 2, 1936.

The meeting was called to order by our president W. D. Scott at 8:15 P. M.

The minutes of the previous meeting were approved as read.

An application for associate membership was made by Mr. Florian E. Webber of 1929 East 85th Street, employed by The Weatherhead Company, was turned over to our Board of Managers.

The election of Mr. Frank A. Truden of 6717 Bonna Avenue, employed by The Western Electric Company, was voted on and he was elected.

A letter from Mr. Yerger, Vice-President of Hanson-Van Winkle-Munning Company was read, thanking us for the interest shown in the Bulletin his company is going to print each day at the convention and asking for the use of the word "Official" to be used in the headlines. Secretary wrote him and said it would be O. K. Also approved.

A letter from the New York Branch of the American Electro-Platers' Society was read asking us to come to New York for the 1937 Convention. It was regularly moved and seconded that we instruct our delegate to vote for New York as our next convention city. Voted on and carried.

A letter from our Supreme President Mr. Slattery was read, the contents of which a new amendment to the Constitution allowing for a full time executive secretary who will take care of the present secretary's and editor's work and the amount of his salaries and expenses would not exceed $3000.00 per year. On a motion made by Mr. Singler and seconded by Mr. Matts that we instruct our delegate to vote against the proposed amendment. Voted on and carried.

The meeting was then turned over to the election of officers for the year.

It was regularly moved and seconded that the same officers be elected for the coming year with Mr. Matts as Librarian. Voted on and carried.

The officers are as follows: President, Mr. W. D. Scott; Vice-President, Mr. Henry A. Webber; Secretary and Treasurer, Mr. W. E. O'Berg; Board of Managers, Mr. J. C. Singler, Mr. P. R. Lyons, Mr. Elmer Peterjohn; Delegates to Convention, Mr. E. Steen Thompson, Mr. W. D. Scott, Mr. Fred Matts; Alternates, Mr. Elmer Peterjohn, Mr. H. A. Webber, Mr. Chas. Ott.

There being no further business, meeting was adjourned.

W. E. O'BERG, *Secy-Treas.*

CHICAGO BRANCH

Chicago Branch held their Educational meeting and Smoker on May 23, 1936, at the Auditorium Hotel.

The attendance was large and many out of town guests were present from Milwaukee, St. Louis, Anderson, and Detroit, and Newark, N. J. Branches being represented.

Mr. O. Sizelove of the Gumm Chemical Co. delivered a very interesting paper on Boric Acid test in Nickel solutions and answered the questions fired at him in a very efficient manner. Mr. Sizelove also made a very interesting talk on Rochelle Salts in Cyanide Copper Solutions.

Mr. H. A. Gilbertson as chairman of the Smoker Committee is to be

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complimented on such a good program.

Mr. O. E. Servis in charge of the Educational Program provided a very interesting session and always sees that we have a good speaker as well as an interesting subject.

Mr. C. S. Tompkins in charge of the entertainment must have seen this part of the program in advance as it was a very fine and interesting show.

One of our most able and popular members of the Smoker Committee, Mr. Frank Hanlon, was taken ill two days before the Smoker and while he was unable to be present at the Smoker he was there in spirit. Chicago Branch officers and members extend their sympathy to Mr. Hanlon and are glad to hear that he will soon be well and back in our midst.

Mr. H. A. Gilbertson quoted the trains and rates to the Cleveland convention and it looks as though Chicago Branch will be well represented.

J. W. HANLON, *Sec.*

Status of the Suit Entered by the Ault & Wiborg Corp'n. Against the Oxford Varnish Company

A method of doing business in which the owner of a patent compels his licensees to buy unpatented materials for use in connection with the patent, has just been condemned by the U. S. Circuit Court of Appeals for the Sixth Circuit in an opinion recently announced.

One of the defendants in the case, the Oxford Varnish Corporation, was the owner of the Henry patent covering a process of making graining plates to be used by metal furniture manufacturers in simulating the color and appearance of natural wood grains. It was Oxford's practice to manufacture the plates and lease them to licensees under its patents upon a royalty basis based upon the amount of finished product produced by them. The leasing contract in effect required the licensees to buy all of the varnishes, inks, paints and lacquers used in the graining operation from Oxford, because if these unpatented materials were bought elsewhere, the patent royalty was declared to be three times the amount that it would be if the materials were purchased from Oxford. The result was that competitors of Oxford who were also in the business of furnishing ink, paints, varnishes and lacquers for use in connection with graining plates, were practically prevented from even soliciting the business of Oxford's licensees in these materials. One of these competitors, the Ault & Wiborg Corporation, brought a suit under provisions of the Clayton Act, to have this method of doing business declared illegal. The U. S. District Court for the Eastern District of Michigan found that the practice tended to establish a monopoly and was in restraint of trade and enjoined the performance of the contract between Oxford and its licensees.

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The Circuit Court of Appeals for the Sixth Circuit has just concurred in this decision.

An interesting feature of the case was that the evidence showed that the total business in paints, inks, varnishes and lacquers done by Oxford in the typical year of 1933, was only Three Hundred Twenty-Five Thousand Dollars ($325,000.00), while the total industrial paint and varnish business in the United States for the same year, was over Two Hundred Twenty Million Dollars ($220,000,000.00). Arguing from these figures, the Oxford Company strenuously urged that no tendency to a monopoly was established. The court found, however, that the ratio borne by the defendant's volume of business to the paint and varnish industry, was not the measure by which the monopolistic tendency of the contracts was determined, as it was of course obvious that the volume of business in materials for use only with graining plates was but a small fraction of the total paint and varnish industry. Deciding, therefore, that a monopoly of a defined portion of an industry is equally subject to the condemnation of the Anti-trust Laws as is a monopoly of an entire industry, the opinion holds in effect that in suits of this character it is not necessary to establish the accumulation of any particular percentage of a total business in order to show restraint of trade or a tendency toward a monopoly. The situation was distinguished from another recent case in which a manufacturer of motor cars bound its dealers not to use second hand parts made by others for replacements in its automobiles, on the ground that replacement parts are not supplies consumed in operation, but operating parts of a complex mechanism, the origin of which is indisputably attributed to the manufacturer.

The court also sustained the right of the Ault & Wiborg Company to maintain the suit as an aggreived competitor. It found as a matter of fact that the Ault & Wiborg Company was able to manufacture paints, inks, varnishes and lacquers which would be just as efficient as those produced by Oxford, but that under the method of doing business, pursued by Oxford, it could not negotiate with the Oxford licensees on an equal trading basis and was wholly and completely shut out from equal competition.

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Membership Report

To May 18, 1936

ELECTIONS

Freeman Edw. Bless, 10 58th Ave. W., Duluth, Minn.
Active, Chicago Branch

Frank P. Cisco, c/o Duro Metal Products Co., 2649 N. Kildare Ave., Chicago, Ill.
Active, Chicago Branch

Rodney N. Olsen, R. R. 2, Box 215, Racine, Wisc.
Active, Milwaukee Branch

Joseph W. Haines, 21 Brookfield Pl., Pleasantville, Westchester Co., N. Y.
Associate, Binghamton-Elmira Branch

Arthur Jas. Moore, 212 Almay Rd., Rochester, N. Y.
Associate, Rochester Branch

Joseph O. Dutton, 317 Rhinecliff Dr., Rochester, N. Y.
Associate, Rochester Branch

Leroy Albert Critchfield, 244 E. Orange St., Lancaster, Penna.
Active, Philadelphia Branch

Thomas G. Lyons, 5752 Fairhill St., Philadelphia, Penn.
Active, Philadelphia Branch

Cecil Roy Roberts, 112 Margaret Ave., Kitchener, Ont., Canada.
Active, Toronto Branch

Merritt Brodie, Ontario Steel Products, Chatham, Ont., Canada.
Active, Toronto Branch

Edwin Hillier, Muellers, Ltd., Sarnia, Ont., Canada.
Active, Toronto Branch

Lawrence T. Killen, Box 781, Temanoque, Ontario
Active, Toronto Branch

A. W. Wilson, International Business Machine, Toronto, Ont.
Active, Toronto Branch

A. S. Ellis, United Car Fastener Co., Hamilton Ontario
Active, Toronto Branch

Frank A. Truden, 6717 Bonna Ave., Cleveland Ohio.
Associate, Cleveland Branch

Herbert Wm. Kennedy, 1530 E. Hancock, Detroit, Mich.
Associate, Detroit Branch

Matt Koch, 1246 Benjamin, Windsor, Canada.
Active, Detroit Branch

Samuel Henry Douglass, c/o R. L. Reed, 2567 Parker Ave., Detroit, Mich.
Active, Detroit Branch

Wm. A. Wischol, c/o Douglas & Lomason Co., 5836 Lincoln Ave., Detroit, Mich.
Active, Detroit Branch

John Pearsall, 1136 Collingwood Ave., Detroit, Mich.
Associate, Detroit Branch

George A. Meyers, Bruce Products Co., 5712 12th St., Detroit, Mich.
Associate, Detroit Branch

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John Ford Harper, 2103 41st Ave., MacFarland Mfg. Co., Long Island City, N. Y. Associate, Bridgeport Branch
Leo A. Donavan, 80 State St., Cambridge, Mass. Active, Boston Branch
Fred Chas. Dykeman, Walpole, N. H. Associate, Boston Branch
Dr. Jean G. Billiter, University of Vienna, Austria. Associate, Baltimore-Washington Branch
George A. Colombie, 295 Hillside St., Torrington, Conn. Associate, Waterbury Branch

APPLICATIONS

Chas. E. Barber, Beverly, Mass. Boston Branch
Joseph M. Hauber, 59 Newton Ave., Braintree, Mass. Boston Branch
Charles Hall, 1267 Tremont St., Roxbury, Mass. Boston Branch
Wesley Colby, Merrimacport, Mass. Boston Branch
Floyd S. Ray, West Newbury, Mass. Boston Branch
Thos. J. Gilmarin, 7 Appleton St., Everett, Mass. Boston Branch
Laurence Tossi, 80 State St., Cambridge, Mass. Boston Branch
Thomas Palmer, 30 Evergreen Ave., Wellesley, Mass. Boston Branch
Arthur H. Eriksen, 138 Adams St., Dorchester, Mass. Boston Branch
Wm. A. Lawrence, 624 Maise St., Walpole, Mass. Boston Branch
Isadore Baker, 1820 Commonwealth Ave., Boston, Mass. Boston Branch
Herbert J. Quigley, 135 Old Colony St., Boston, Mass. Boston Branch
Edw. F. Foster, United Carr Fastener Corp., 31 Ames St., Cambridge, Mass. Boston Branch
J. Arthur Zimmer, 137A Condor St., East Boston, Mass. Boston Branch
Wm. F. Langemayr, 515 S. Edwards Ave., Syracuse, N. Y. Binghamton-Elmira Branch

TRANSFERS

John Honnecker from Newark Branch to Rochester Branch
I. D. Niles from Bridgeport Branch to Springfield Branch

SUSPENSIONS

Chas. F. Conlin, 2800 Center St., Sioux City, Iowa. Milwaukee Branch
Frank Kakatsch, Oconomowoc, Wis. Milwaukee Branch